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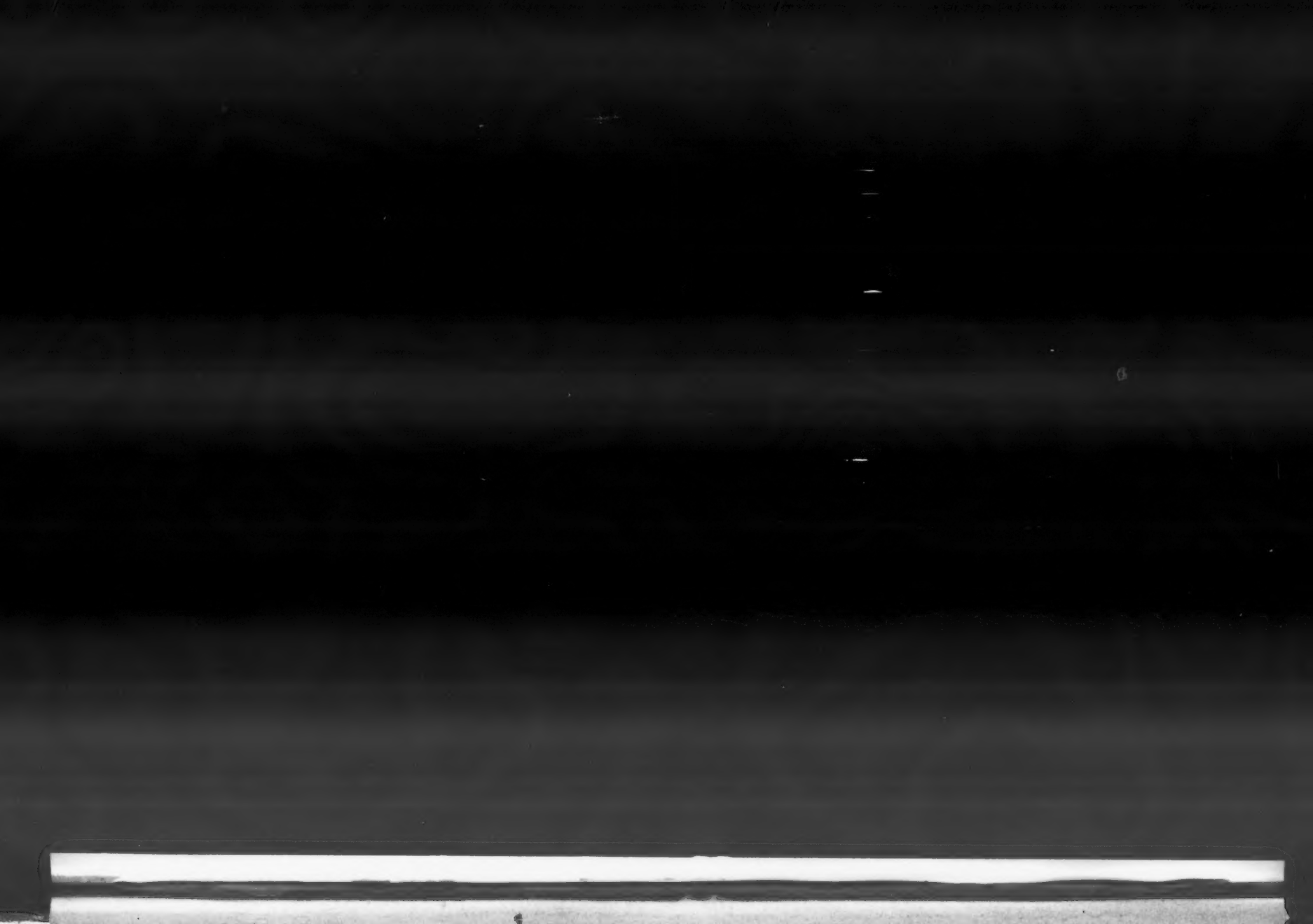

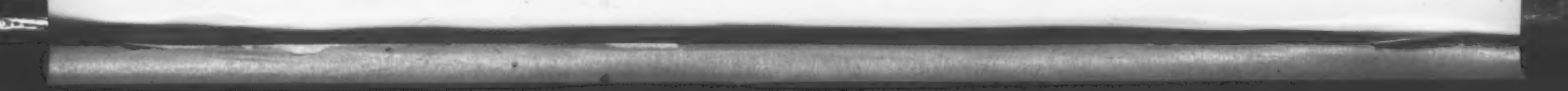

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MUNICIPAL ENGINEERING

VOLUME XXXV. SEPTEMBER, NINETEEN HUNDRED EIGHT. NUMBER THREE.

BRICK STREET PAVING IN COLUMBUS, O.

AN article on street paving in Columbus, Ohio, is practically an article on brick street paving, if the materials for the new pavements are considered, for of 130 streets or parts of streets to be improved in 1908, 101 of which are in the hands of the contractors or have been completed, only five are of asphalt and four of macadam and ninety-two are of brick. The percentage of brick in the last two years has been so large that it will materially increase the relative amount of brick paving in the city, which in former years has been approximately 70 per cent. of the total length of streets paved with permanent materials, including asphalt, stone, brick, boulders and macadam. The present administration does not publish annual reports of work done, and so the exact mileage and area of improved streets is difficult to obtain. The following tables, taken from the list of contracts in the city engineer's office, give some information regarding the contracts let for completion of work in 1908 and those which may be let before the close of the season:

Brick Paving Contracts in Columbus, O., 1908.

Street.	Area Sq. Yds.	Contract Price. Brick on Concrete Per Sq. Yd.	Contract Price. Total, Including all Accessories.
Atcheson	4,000	1.58	$9,428
Beck	6,780	1.61	15,523
Bedford	3,450	1.70	9,571
Al. n. of Boyden	430	1.62	824
Boyden alley	2,660	1.80	5,460
Central	1,350	1.62	4,183
Clifton	2,000	1.55	.....
Crawford	2,550	1.65	5,737
Cherry	1,950	....	4,744
Clarendon	9,450	1.70	24,111
College	2,100	1.62	4,595
College	1,425	1.75	2,856
Chapel	600	1.75	1,598
Clifton	5,700	1.73	17,301
Capital	1,500	1.78	3,198
Collins	2,800	1.70	6,709
Carpenter	4,050	1.74	12,059
Dublin	8,700	1.61	22,237
Delaware	2,025	1.70	3,766
Davis	7,100	1.68	17,601
Deshler	1,900	1.90	11,766
Dana	1,260	1.61	20,255
Eighteenth	9,600	1.57	20,112
Eighteenth	4,350	1.74	12,251
English alley	420	1.75	885
Engler	550	1.72	1,790
Engler	2,500	1.74	6,934
Fifth	2,050	1.55	5,310
Fulton	2,120	1.62	8,084
Fourth	9,200	1.67	16,813
Frambes	2,400	1.60	7,967
Fulton	3,075	1.65	7,201
Floral	4,150	1.70	12,781
Alley n. of 5th	625	1.70	1,322
Fifth	2,050	1.55	4,981
Farmwood	7,350	1.65	19,926
Fulton	1,710	1.15	1,986
Fulton	14,900	1.75	35,259
Fourth	13,300	1.65	34,867
Gates	3,350	1.64	3,350
Gay	500	1.59	1,029
Grape alley	760	1.65	1,836
Gilbert	3,900	1.74	11,088
Gift	5,300	1.69	27,049
Hawthorne	5,620	1.60	13,902
Hankins	400	1.84	1,094
Harrison	4,020	....	9,277
Hunter	4,130	1.70	9,272
Hunter	3,850	1.70	8,640
Highland	3,250	1.70	8,024
Jaeger	1,000	1.62	2,107
Kimball Pl.	3,450	1.65	3,625
Lechner	5,300	1.60	14,024
Lane	7,100	1.73	18,092
Al. n. of Madis'n	1,060	1.65	1,132
Monroe	3,140	1.65	7,680
Mohawk	7,300	1.72	14,582
Mithoff	1,800	1.60	4,529
Moler	10,300	1.60	29,410
Monroe	450	1.75	891
Alley s. of Mt. Vernon	630	1.81	1,343

Main	7,140	1.70	16,027
Mound	20,450	1.62	48,894
McDowell	2,300	1.68	5,335
Norwich	4,300	1.60	8,781
Ninth	1,430	1.70	3,858
Nineteenth	570	1.70	1,099
Northrup alley	1,750	1.85	3,462
Ninth ave	2,050	1.70	4,676
Oakland	2,820	1.64	6,836
Ogden	4,400	1.76	10,525
Oakland	5,600	1.66	17,148
Princeton	7,700	1.60	18,520
Parsons	7,600	1.62	13,404
Perry	8,800	1.67	19,521
Pennsylvania	3,500	1.70	7,808
Seventeenth	3,700	1.64	9,882
Studer	3,950	1.70	11,358
Skidmore	7,200	1.68	17,173
Swan	1,260	1.73	2,967
Say	450	....	3,681
Sandusky	14,600	1.60	39,135
Sycamore	11,580	1.70	27,040
Tatnick	3,000	1.70	8,718
Terrace	2,150	1.80	6,167
Walnut	1,350	1.63	3,427
Winner	1,150	1.60	2,583
Woodruff	2,100	1.60	5,707
Wheatland	5,300	1.76	13,607
Warren	4,400	1.76	10,582
Whitethorne	4,270	1.74	11,025
Yale	6,600	1.60	14,132
92 streets	394,230		$956,445

This area is equivalent to a 30-foot street 118,000 feet or about 22 miles long.

Asphalt Paving Contracts in Columbus, O., 1908.

Street.	Area Sq. Yds.	Contract Price. Asphalt Per Sq. Yd.	Brick Gutters Per Sq. Yd.	Total, Including all Accessories.
Bryden	3,730	2.15	1.71	$10,331
Franklin	2,600	2.15	1.71	7,875
Fifth	3,150	....	1.61	7,418
Linwood	10,400	2.05	1.84	26,112
Oak	1,950	2.15	1.71	5,799
5 streets	21,830			$57,535

This area is equivalent to a 30-foot street 6,550 feet long.

Macadam Paving Contracts in Columbus, O., 1908.

Street.	Volume Cu. Yds. in Place.	Contract Price. Macadam Per Cu. Yd.	Total, Including all Accessories.
Franklin Park S.	1,000	$1.70	$3,233
Midland	3,600	1.75	10,719
McKinley	1,200	1.66	2,772
Ohio	620	1.65	1,077
4 streets	6,420		$17,801

This volume of macadam paves approximately 15,000 square yards of roadway, equivalent to a 30-foot street 4,500 feet long.

Street Paving in Contemplation in Columbus, O.

Street.	Area Sq. Yds.	Estimated Cost.
Brehl	3,570	$9,535
Burgess	7,900	18,895
Alley n. of Broad	680	1,480*
Alley n. of Bryden	1,010	2,087*
Champion ave. alley	1,200	2,588*
Cherry	4,500	11,511
Duncan	1,600	4,471
Dublin	2,025	3,881
East	2,700	7,493
Edward	3,400	.....
Goodale	1,900	4,557
Haveland (grading)	5,400	2,700
Hunter, brick	2,150	5,879
Hunter, asphalt	2,150	6,846
Hill	1,000	2,505
Highland	1,775	4,217
Kelly alley	700	1,560*
Miami (repairing macadam)	.....	1,430
McAllester	3,900	10,433*
McCoy	1,300	3,425
Northwood (mac'd.)	600	2,694*
Oregon	1,700	4,940
Staureng	2,250	6,689
Sixth	2,700	9,093
Scioto	4,790	10,898*
Twenty-second	1,300	4,040
Third	4,200	10,657
Woodland (resurface macadam)	.....	5,472*
Wood	2,200	5.033
Walnut	1,680	4,361
Young	1,450	3,741
31 streets	71,030	$173,016

On eight of these streets, marked *, aggregating 12,880 square yards and $37,212 estimated cost, bids were received about August 28.

Each of the asphalt contracts contains a considerable area of brick, for wide brick gutters are provided in the regular plans for asphalt streets.

Including the brick laid in asphalt contracts the Nelsonville product is used on 54 streets, that from Athens on 37, the Carlyle block on 2 and the Harris block on 1. Trinidad Pitch Lake Asphalt is used in all asphalt streets and stone from quarries in the vicinity in the macadam streets.

The contractors doing the work are Baldwin Brothers and Graham, of Cleveland and Columbus, with 14 brick contracts; N. B. Abbott, Columbus, with 11; D. E. Sullivan and Son, Columbus, with 10; W. H. Luchtenberg & Co., S. T. Knight and Geigele,

Garnes & Co., all of Columbus, with 9 each; A. G. Pugh, Columbus, with 4 asphalt and 5 brick contracts; J. C. Beasley, Columbus, with 6 brick contracts; H. J. Shaw, Columbus, with 5 brick and 1 asphalt contracts; M. J. Burns, Columbus, with 4 brick and 2 macadam contracts; Wm. E. Schwartz, Columbus, with 5 brick contracts; C. H. Walcutt, Columbus, with 2 brick contracts; and W. C. Wooley & Co., Marion, O., with 2 macadam contracts.

The specifications for brick paving provide for a rolled subgrade and a 6-inch concrete foundations with proportions of materials of 1 Portland cement, 4 sand or limestone dust and 8 broken stone. Limestone gravel from the river is used, broken, if necessary, to pass a 2-inch ring. River sand is also used. Alma, Universal and Lehigh brands of Portland cement were observed on streets under construction. The Scheffler mixer seems to be popular with contractors.

Curbing and, when necessary, 4-inch sub-soil drains along the curb and 1 foot below the subgrade are laid before the subgrade is rolled.

When the concrete is deposited and tamped, its surface is brushed and mortar is deposited on it until it is smooth, when a thin layer of sand is spread over it. The surface of the concrete is thus practically an exact parallel to the finished brick surface. The sand cushion is 1 inch thick and is of bank sand containing some clay, this material apparently producing the most satisfactory cushion. Since the surface of the concrete is so smooth a greater thickness than 1 inch for the cushion is not deemed necessary. Bricks and blocks are used, 8 to 9 inches long, 2¾ to 3¾ inches wide and 4 to 4½ inches deep, repressed, with ⅜-inch round corners. The unrolled brick surface is unusually smooth, owing to the smooth concrete and carefully screeded sand cushion and the same smoothness is retained after the ramming and rolling.

Tar is the most popular filler and its use reduces the amount of noise of traffic on the pavements to a minimum. The specifications require the joints to be filled half full of lake sand and the remainder of the joint to be filled with No. 6 coal tar paving cement applied at a temperature above 300 degrees when the bricks are completely dry. The specifications are not very strict upon the filling of the joints, and new streets show many joints slightly below the regular surface. A ½-inch sand dressing remains on the surface for a month after the pavement is opened for travel.

The excellent quality of most of the brick used in paving Columbus streets is shown by the good condition of even the oldest streets, a very small proportion of them and these more than fifteen years old, showing roughness enough to suggest the necessity of renewing the wearing surface. The concrete foundation has been used for a very few years and some of the roughness of the older streets is due to unequal settlement of the broken stone foundations formerly used.

We are indebted to the courtesies of Henry Maetzel, city engineer, and R. S. Blinn, assistant engineer in charge of the paving division, for the opportunity to present these data.

SEWER TRENCHING IN WET SAND.

By C. M. Ripley, New York City.

THE Magic City of Steel, Gary, Indiana, which represents an expenditure of $75,000,000, has attracted much attention in the world of engineering, owing to the magnitude of the work, the speed of construction and the methods adopted. With a population of 15,000, Gary is scarcely two years old, yet it has over ten miles of paved streets, twenty miles of gas mains, an electric light plant, full telegraph and telephone service, both local and long distance, and now an elaborate system of sewers, about twenty miles in length, is nearing completion.

The sewer system will cost about $350,000, and about half of this contract was let to Green & Sons Company, contractors, of Chicago, Ill.

This article deals with the methods and costs of the contractor in overcoming the difficulties of the quicksand, which will flow in from a radius of fifteen feet when an excavation one foot in depth is left unconfined. This sand, when dry, is so fine that one walks in it ankle deep. So low is the

land, also, in comparison with Lake Michigan, that in many places there are surface ponds three and four feet deep.

To make the preliminary excavation of the trench to a depth of eight feet, a two-yard Page & Schnable bucket excavator was hung from a 40-foot boom, with the usual cable and chain attachments. Second readings of the movements of this machine were as follows:

Time of Day.	Began.	Time Elapsed for Each Item in Seconds.
4:22:05	Hoisting full bucket	5
4:22:10	Swinging to embankment	5
4:22:15	Dumping	5
4:22:20	Swinging back	5
4:22:25	Lowering to trench	5
4:22:30	Digging	15
4:22:45	Hoisting full bucket	5
4:22:50	Swinging to embankment	7
4:22:57	Dumping	5
4:23:02	Swinging back	3
4:23:05	Lowering to trench	5
4:23:10	Digging	15
4:23:25	Hoisting full bucket.	
		80

Total for two round trips being 80 seconds, or 40 seconds per round trip on the average. Thus it will be seen that 38 per cent. of the entire time of this machine was expended in the digging movement. The sand on this job was what might be called perfectly wet—that is, the voids were entirely filled with water. Its weight, therefore, can be taken as about 33 per cent. greater than dry sand, or 120 pounds per cubic foot. Thus, the two-yard bucket, when full, must contain about 2x27x120 pounds, or about three tons of sand. This fact will assist us in understanding the slowness of the digging operation.

It must be borne in mind that this scraper was only doing the surface or preliminary excavation; also, that the material is practically quicksand, and that it would be useless to try to dig lower than the water level. An interesting process was the manner in which some of the excavated material was dumped straight ahead in the path of the machine, so that the excavator was building its own roadbed over the swamps ahead, with the material it excavated behind.

The average progress per day of the entire sewer work was 60 lineal feet. The scraper bucket handled about 600 cubic yards per day, costs being:

1 engineer	$5.00
1 fireman	3.00
3 laborers	6.00
Coal	6.25
Total	$20.25

Which, divided by 600, gives 3½ cents per yard as the unit cost, not figuring superintendence or depreciation. The cost per lineal foot of trench is 34 cents. This machine was not trying to make a record, but was only working fast enough to keep ahead of the deeper excavation and brick work. In one day it excavated 850 yards in an emergency.

The entire machine is pulled ahead by simply lowering the bucket and letting it get a good "bite" on the ground ahead, then by winding up on the "digging" cable the whole apparatus will move forward on its rollers. These rollers are chocked behind by pieces of angle iron, so that in the regular process of digging there will be no retrograde movement.

The drainage of the sand for the excavation of the remainder of the trench was then provided for by means of well points located as shown in the accompanying sketch and connected to three vacuum pumps.

It will be seen from the illustration that the first vacuum pump has to do with draining the excavation immediately adjacent to the scraper bucket excavator. Its suction pipe is connected with a horizontal 4-inch header, as shown. The 2-inch well points are 3 feet long and are connected with 2-inch pipes 13 feet long, which are jetted in a double row near the center of the trench. This arrangement is made so as to allow the sheeting to be driven on either side. This pump draws water from:

132 2-inch well points sunk 16 feet below water level.
1 4-inch well point sunk 16 feet below water level.
1 4-inch suction pipe, with strainer, placed on the front end of the horizontal header and draining surface water.

The pumps are hung by chain falls from A-frames, the first A-frame being mounted on rollers placed on 3x12x16-foot plank, to facilitate its forward movement as the excavating progresses. The sheeting prevents the other frames being so mounted. The pumps are vacuum pumps, with 5-inch suction and 4-inch discharge pipes and 725 g.p.m. capacity.

The 4-inch horizontal header mentioned in connection with pump No. 1 is made up of sixteen sections joined by flanges. When the work progresses 22 feet, that being the length of each section, the rear section is removed and placed in front, and so on. Gate valves at frequent intervals make it possible to do this without

shutting down. Thus the pump can remain in one position, even though the excavation has been carried forward 6 times 22, or approximately 120 feet.

The vertical pipes leading down to the well points have ells at the top, and a 4-foot length of hard wire-lined rubber suction hose makes the connection to the main header. Each 22-foot length of this header has eleven cross valves, with two bushings each, to accommodate the rubber connections.

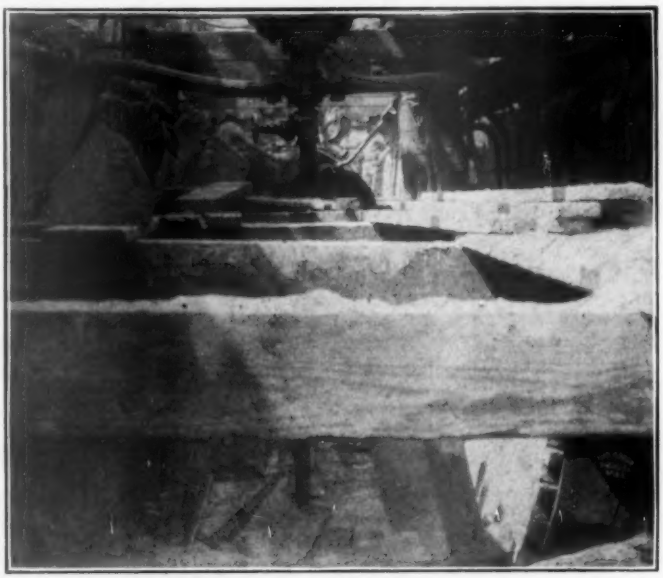
After the draining has been carried on for a couple of hours in the first of the six sections attached to pump No. 1, 2x6x12-foot wooden sheeting is driven by mauls on both sides of the sixth section. Then excavation is started by the shovelers and is carried down about 6 feet more. It is at this point that the well points attached to pumps Nos. 2 and 3 are jetted down another 16 feet so that they penetrate below the bottom of the lowest excavation, and 6 feet below the bottom of the sheeting. Thus the total depth of the trench is made up of the following stages:

(1) 8 feet, down to water level, by bucket excavator.
(2) 6 feet, near pump No. 1, by shovelers.
(3) 16 feet, under pumps Nos. 2 and 3, by shovelers.

The entire excavation was comparatively dry sand, and would stand at ½ to 1, although if wet it would not stand better than 15 to 1.

The second and third pumps have their suction pipes, as the electrical engineer would say, "operating in parallel;" that is, they are both drawing water from the same piping system. The suction pipe of both draws water from:

1 4-inch suction hose straight below pump.
1 4-inch rubber hose leading to the right.
1 4-inch rubber hose leading to the left.



SEWER TRENCHING IN WET SAND.
Connections of Well Points to Pump.

This arrangement is effected by means of a 4-way connection in the suction of each pump, and about one foot below it. The two 4-inch rubber hose branching off horizontally from the 4-way connection and at right angles to the trench, are only long enough to connect through a tee with 2-inch iron pipes, also horizontal, which extend along the sides of the trench just inside the sheeting. It is to these latter pipes that the 1¼-inch well points are connected and jetted down as close as possible to the sheeting, so that the shovelers can work inside the vertical drain pipes without hindrance.

Again gate valves at frequent in-

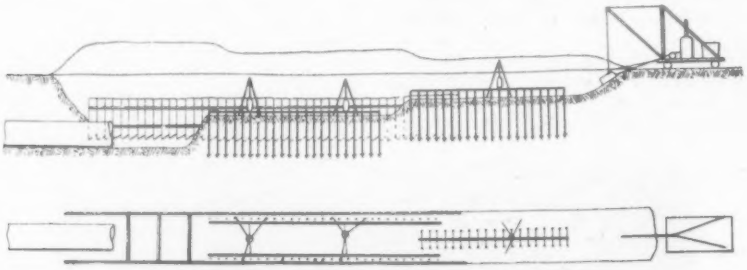
tervals allow of considerable flexibility, so that lengths can be shifted from rear to front as the digging proceeds. Another and most interesting feature is that the pumping can be made stronger in any part of the excavation where specially large quantities of water may be encountered. Thus the entire combined capacities of both pumps can be concentrated on those well points in the wettest part of the work by closing the gate valves and shutting off the vacuum from other parts of the trench pipe line. This would, of course, be impossible if an ordinary "sump" were used, for as the work went ahead new sumps would have to be dug and braced and additional pumps hung at a considerable total expense. The idea of a distributed suction, as used at Gary, makes the pumping more efficient than the old sump method, because the water is drained from the exact location of the excavation instead of from a circular area, mostly outside the limits of the trench, and within a certain radius of the pump.

Two men were timed while using a 1-inch pipe for jetting down the well points. The water pressure was about 100 pounds per square inch, and the two men sunk four 1¼-inch well points 16 feet in one minute. This obviously does not include the time making connections with rubber hose to the horizontal 2-inch headers.

It is a fact worthy of note that the hundreds of connections between flanges, rubber hose, ells and suction pipes cannot be made absolutely airtight, and that, with the high vacuum inside, a considerable amount of air must find its way into the suction of the pumps. This fact does not seem to hinder the action of these pumps, owing probably to the large volume of the chambers in which the condensed steam forms the vacuum.

The photograph shows the last stage of the trench work. The invert is completed. The connections of the well tubes next the sheeting to the pump, hung in the middle of the trench, and the suction pipe for external water, seepage and leakage are clearly shown.

Mr. Sargent, representing the consulting engineers for the job, and Mr. Green, the contractor, are highly pleased with the novel arrangement and the economy in labor which it is effecting. They say that were a shutdown to occur which would cause a delay of even half an hour, it would make the excavation so wet as to become extremely dangerous to the workmen, and make the costs much higher, owing to the unusual fluidity and fineness of the sand.



SEWER TRENCHING IN WET SAND.

Distribution of Well Points for Removing Water.

The discharge pipes of the first three pumps empty into a 10-inch tile drain laid in a small trench by the side of the main excavation. This, in turn, discharges into the completed sewer on the far side of a dam of sandbags. The amount of water so discharged has not been accurately measured, but it is a rushing stream, two-thirds filling the 10-inch drain pipe and flowing at a rapid rate, owing to a drop of over 20 feet in 200.

The back-water in the completed sewer is about 4 feet in depth, and the seepage through this dam, as well as that which enters the sewer through other channels, is sufficient to keep a fourth pump working continuously night and day. A temporary manhole was built in the center of the arch, and in this was suspended an Emerson pump No. 1, with a capacity of about 250 gallons per minute.

The contractor, in speaking of the new method, said that he has already proved his earlier estimate to be correct; that the small investment for the pumping plant was more than offset by the remarkable saving in labor and the increased speed of the work.

He states that a laborer can handle several times as much sand in the damp state as he could if it were either dry or very wet, as dry sand falls off the shovel and wet sand is washed off.

It is claimed by some who have followed the work pretty closely that if completed at the present rate there will be a saving made of about $40,000, because the excavating gang is working under the best conditions, although 22 feet below water level, and that with ordinary wood sheet piling driven by mauls. Another advantage of the damp sand is that it can be packed, and this affords a firm bed for the brick sewer invert.

After the brick work is completed, pumping in that part of the trench is continued for about half an hour, to make sure the proper setting of the cement mortar. To hasten this process half Universal Portland and half Utica hydraulic cements are used.

The lowest trench braces were taken out after the invert was completed, and before work was begun on the arch. This was made possible because the sheeting extends one foot below the top of the invert, and is thus held in place.

An industrial railway of 2-feet gauge, with wood ties and 12-pound rails, parallels the sewer route for 2,800 feet. This is of considerable uses in carrying materials from the railway switches and distributing along the job. Teams of horses and then mules were tried to haul the side dumping cars on the track, but owing to rapid progress and the resulting frequent changes in the track, together with the extreme softness of the sand, it was found that laborers could go where the teams would not.

Summary of Contractor's Plant.

Piping system as described.

300 (approximately) well points.

Three No. 3 Emerson standard vacuum pumps.

One No. 1 Emerson standard vacuum pump.

One small duplex force pump, for jetting.

One small boiler for same.

One Lidgerwood piledriver, boiler supplying small Emerson pump.

Three horizontal 30-h.p. boilers for supplying large Emerson pumps.

2,800 feet industrial railway, with 12 side-dump cars.

One 2-yard Page & Schnable drag bucket excavator, with 40-h.p. engine.

One 1-yard Hayward clamshell for back-filling.

One engine and derrick for same.

Since the entire coal bill for the job averages $25 per day for twenty-four hours, and assuming that the four Emerson pumps, together with the small duplex force pump, consume half this fuel, then the clamshell and bucket excavator will, together, use approximately $12.50 worth of coal per day, with coal at $3.60 per ton. The clamshell and scraper bucket, we will assume, require equal amounts of fuel. Thus the cost of 500 yards back-fill, put in in nine hours by the clamshell, figures as follows:

One engineer	$5.00
One fireman	3.00
Three laborers	6.00
Coal	6.25
Total	$20.25

Which, divided by 500, gives about 4 cents per cubic yard as the unit cost of back-filling, or 34 cents a lineal foot of trench. But part of the back-fill is done by shovelers immediately after the arch is finished.

COST OF WORK FOR DAILY PROGRESS OF SIXTY FEET.

Cost of driving and pulling sheeting and setting braces (nine hours)—

4 men setting braces	$2.25	$9.00
3 men driving sheeting	2.50	7.50
4 men pulling sheeting	2.50	10.00
1 carpenter		3.00
Total		$29.50

or 49 cents per lineal foot of trench.

Cost of pumping and changing piping system (day and night)—

Fuel for 24 hours		$10.00
12 pipe-line men	$2.25	27.00
6 firemen	3.00	18.00
2 superintendents	3.00	6.00
Total for the 3 big pumps.		$61.00

or $1.02 per lineal foot of trench.

Cost of keeping out back-water (night and day)—

Fuel for 24 hours		$2.50
2 firemen	$3.00	6.00
Total		$8.50

or 14 cents per lineal foot of trench.

Cost of clearing timber (nine hours)—

2 men	$2.00	$4.00

or 7 cents per lineal foot of trench.

Cost of handling earth, and trench expense per day—

	Total.	Per ft. of Trench.
Bucket excavator, day only, including fuel	$20.25	$0.34
Pumping out trench and changing pipes (24 hrs.).	61.00	1.01
140 shovelers (day only), $2.15	301.00	5.02
Back-filling (day only)	20.25	0.34
Sheeting and bracing (day only)	29.50	0.49
3 water boys, $1	3.00	0.05
Totals	$435.00	$7.25

The cost of occasional railroad trestles and unforeseen accidents cannot be included in the above. Credit must be given to the contractor for many low costs under these conditions, and for good management of labor, and care to provide against accidents in the treacherous sands bordering Lake Michigan.

The parties engaged are as follows: A. P. Melton, city engineer of Gary, Ind.; Alvord & Burdick, consulting engineers and designers; W. F. Sargent, their local representative; E. M. Scheflow, engineer of construction, and R. Shackleton, superintendent for Green & Sons.

[EDITORIAL NOTE.—Other reports of the cost of this work differ somewhat in details, but not much in total cost, one other estimate being 10 per cent. less than the total given above. The difference between the two estimates was mainly in the number of shovelers, one being about half that given above.]

THE BIG COTTONWOOD WATERWORKS CONDUIT OF SALT LAKE CITY, UTAH.

THE various supplies of water to Salt Lake City, Utah, for domestic and municipal purposes and for irrigation are obtained from Utah Lake and from various mountain streams. By a process of exchange and lease of water rights the city obtained the right to most of the water from City creek, Emigration creek and Big Cottonwood creek. The latest acquisition is that from Big Cottonwood canyon, which necessitated the construction of the Big Cottonwood conduit, 7.23 miles long, from the diverting dam at the mouth of the canyon to Parley's canyon conduit, which carriers the waters of both to the city. The plans contemplate the further extension of the conduit to take the waters of Little Cottonwood creek.

The following description of the conduit construction is abstracted mainly from the report of City Engineer L. C. Kelsey, to whom we are indebted for the accompanying illustrations of the progress of the work.

On September 6, 1905, the city entered into a contract with P. J. Moran for the construction of a concrete conduit from Big Cottonwood creek to the south bank of Parley's creek canyon. The plan of construction was as follows:

Form of conduit, rectangular. Extreme width of inside, 3½ feet. Depth inside, four feet with a depression of two inches in center of floor.

Side walls six inches thick; floor eight inches at side, six inches in center; roof, flat, from four to six inches in thickness according to the depth of cut in which conduit was constructed. Reinforced with ⅜ and ½-inch twisted steel bars, spaced from 6 to 9-inch centers with additional longitudinal bars where the conduit was built on piers above the surface of the ground.

The roof of that portion of conduit constructed in tunnels to be nine inches thick of selected pressed brick, arched, covered with cement mortar on outside and unplastered inside.

The conduit was unplastered, but side walls and bottom were to receive a coat of grout, composed of equal parts of sand and cement.

The method of construction called for building the sidewalls first, which were allowed to set. The forms were removed and bottom construction between side walls. The floor was then allowed to set four days or more before construction of roof was allowed.

During the months of September to December, 1905, inclusive, about 50 per cent. of the excavation, 6,380 feet of conduit, was entirely constructed and 1,050 feet partly constructed according to the original plans, with this exception, that it is due to the contractor to state that in all work prior to the changes hereafter mentioned the bottom and side walls were simultaneously constructed and the sand was omitted from the grout.

Under the original plan, approximately one and one-half miles of the entire length of the conduit was not covered with earth.

Following a thorough inspection of work completed during the year 1905, on February 19, 1906, a recommendation was made by this office that certain changes be made in the method of construction and in the form of the conduit; that the conduit be plastered inside with cement plaster and that as far as possible, the conduit should be covered for its entire length with a mimimum depth of two feet of earth.

I. BIG COTTONWOOD CONDUIT, SALT LAKE CITY, UTAH.
Showing Forms Ready for Placing Concrete.

This recommendation was concurred in by the Board of Public Works and the work ordered by the city council. The remainder of the conduit, from Station 116.00 to Station 386.67, was therefore constructed to the new form which was,—

The floor remained the same as at first except the square corners were rounded to prevent impurities lodging therein. Side walls were increased to eight inches in thickness, roof increased to six inches in thickness in center and arched with a rise 10.3 inches and skew back 10.3 inches deep.

The forms used in depositing concrete were placed in such a manner that the entire floor, side walls and arch were deposited simultaneously, making a perfect monolithic construction and adding much to the strength of the structure. Concrete was substituted for the pressed brick arch construction in roof and tunnels, as the latter material is unfit for construction work where the surface is exposed to the action of the water. A provision for emergency and sanitation was also made by the construction of three blow-off valves with mud drums at convenient points along the line.

On August 10, 1906, the concrete construction of that part of the conduit for which contract was let was completed. On the 31st day of December the conduit construction was complete, including 99 per cent. of the backfilling.

The conduit is 38,167 feet, or 7.23 miles, in length and has a capacity of 32,000,000 gallons per twenty-four hours.

Total cost of conduit, including connections to Parley's Canyon Reservoir to January 1, 1907, was as follows:

	1905.	1906.	Total.
Contract work	$70,973.80	$286,050.50	$357,024.30
Metal reinforcement	2,625.12	15,388.36	18,013.48
Steel and iron	1,376.00	955.00	2,331.00
Engineering	17,066.12	7,724.98	24,791.10
Inspection	811.75	3,629.21	4,440.96
Advertising	106.38	.....	106.38
Right of way	.....	4,961.80	4,961.80
Totals	$92,959.17	$318,709.85	$411,669.02

This amount is made up as follows:

Conduit	$376,617.73
Improvement of Parley's Canyon reservoir	13,721.37
Dam and headworks at Big Cottonwood creek	18,399.95
By-pass at Parley's Canyon reservoir	2,929.97
Total	$411,669.02

When all work was completed and expenses paid about $30,000 was added to the cost above reported.

The conduit was put into use on February 5, 1907, at 5:11 p. m., the entire flow of the creek passing over the weir at about 6 o'clock. The depth of the water flowing over the weir was 10⅛ inches, or 76.93 second-feet, equal to 49,722,000 gallons per day. Of this amount 35.9 second-feet, or 23,203,000 gallons per day, was turned into the conduit.

The first waters arrived at Parley's canyon at 7:33 p. m., making the time of passage 2 hours and 22 minutes.

On February 9th there was flowing through the conduit 20.44 second-feet, or 13,211,000 gallons, per day.

The first of the accompany photographs shows the forms for placing concrete, so arranged that the bottom, sides and top can be deposited as a monolith. The outside posts are 4 by 6 inches; the inside 2 by 4. Caps are 4 by 6 inches. Outside sheeting is 1 by 12 inch with one 2-inch and two 1-inch ribs; inside sheeting 1 by 4 inch matched flooring. Ribs of roof forms are 2-inch and sheeting 1 by 4 inch flooring. Panels are 6 feet long.

Plate II shows the end of a completed section of the conduit ready for the erection of forms to extend it.

Plate III shows the location and method of operation of the concrete mixer, which was set over the conduit so that construction progressed about 500 feet each side of it before it was moved to a new location. Cars were used for carrying the concrete to the place of deposit, run on a track carried on stringers laid on caps supported by the outside posts of the forms. Work was begun at the farther end of the 500-foot sections and joined near the mixer to prevent running the loaded cars over the completed concrete.

Plate IV shows forms, track, cars and concrete mixer on a curved section of the conduit, much of it above the surface of the ground.

Plate V shows another uncompleted

II. BIG COTTONWOOD CONDUIT, SALT LAKE CITY, UTAH.
Showing Section of Concrete as Completed.

section with the concrete cars passing back and forth on the track over the forms.

Plates VI and VII show two completed sections of the conduit. Under the final specifications the conduit was covered with at least two feet of filling.

Plate VIII shows the excavation of a rock tunnel for the conduit, ready for the concrete lining.

Plate IX shows the culvert on which the conduit crosses Mill creek. Above this point the gradient of the conduit is 0.12 per cent. Below it is 0.15 per cent., which increases the capacity of the conduit to 39,000,000 gallons a day, thus allowing for the interception of Mill creek when that is considered to be desirable.

STATE CONTROL OF PUBLIC WATER SUPPLIES.*

By Dr. Charles O. Probst, Secretary State Board of Health, Columbus, O.

A FEW years ago the writer was visiting a friend some twenty-five miles from home, and in driving about the country stopped at a little hotel, kept by a widow, for dinner. The picture of a fine young man, of about twenty-four, attracted my attention. I asked the proprietress who it was. With tears stealing down her cheeks, she informed me that it was the picture of her only son, who had died a few weeks before from typhoid fever, contracted in Columbus. There is a small pleasure resort on an island in Lake Erie, in the State of Ohio, where many thousands of visitors go for a day, or a few hours between boats, during the summer. The sewage from many hotels and eating houses pours into a land-locked bay, where are also the boat landings. Water is pumped from this bay and is served at many places for drinking purposes. How many cases of sickness, never traced to this source, are caused by these conditions, none can tell. The villagers have been indifferent and unwilling to bear the expense of introducing sewerage and pure water.

Should the correction of such conditions, which I presume exist in most of the states and provinces, be left entirely to the local authorities? Most emphatically not, in my opinion. If a polluted public water supply concerned only the community that uses it, there might be some argument in favor of home rule; though in this case it would more properly be home misrule. But this is not a local question. In these days of rapid transit and involved business and social relations, conditions differ greatly from what they were in the walled cities of former generations. The state has become, in large measure, one community, and it must assume increasing responsibility for the conditions which threaten the lives and health of the people. If the state has the power to prevent a municipality from furnishing impure water, we cannot escape the conclusion that it should use this power when that becomes necessary.

When and to what extent should the state assume control of public water supplies? In the first place, it should be the duty of the state to protect from pollution, as far as possible, all sources of water supplies of which use is being made. Municipalities might be given power to protect themselves, but this is a grant of power that municipalities are very slow to make use of. For instance, in Ohio municipalities have authority under the law to prevent and punish pollution of a public water supply within a distance of twenty miles, but no use has been made of this power. And why twenty miles? How far may dangerous pollution of streams extend? The old English Commission said there was no stream in England long enough to recover itself. True, the streams in England are not very long. Was St. Louis hurt by Chicago? Many think so, and the United States Government was appealed to for protection. Suppose Chicago should admit it, but say to St. Louis: "Remove the little pollution we contribute to your water supply by proper methods of purification."

The question coming up in all populous states is: Can the streams and watersheds that must furnish public water supplies be kept free from contamination by laws and inspection?

*A paper before the American Public Health Association.

III. BIG COTTONWOOD CONDUIT, SALT LAKE CITY, UTAH.
Showing Concrete Mixer and Track for Hauling Concrete.

This may be possible for some of the states, but not for the great Middle West territory, where usually municipal and industrial wastes must go to the streams.

Should these wastes be purified in all cases where the stream is used in any part of its course as a public water supply, or should water purification be depended upon for protection? We cannot settle this problem for all communities in general terms. Each community affords a problem of its own. We may have to cleanse the sewage of the town above and purify the water of the one below in order to protect the latter. In other cases it is possible that either procedure would accomplish this. In that case, who shall decide whether the town above shall purify its sewage, or the users of the water below be made to filter it?

The state, as I see it, can best settle such questions. It may do this by giving adequate authority to some commission to control all sources of public water supply, and to prohibit the use of its waters for the disposal of municipal or industrial wastes without the permission of such commission. Instead of creating a special commission for such work, it is much better, in my judgment, to give this authority to the state or provincial board of health. I can best express my views of what should be the relation of the state to municipal water supplies by giving the salient features of recent legislation in Ohio, and this is my excuse for referring to home affairs.

The act under which the State Board of Health has operated since 1893, in the approval of plans for water or sewage works, was materially strengthened by adding a penalty of from one to five hundred dollars for its violation. In addition, no garbage or manufacturing plant having a liquid waste, which may enter any stream within twenty miles above the intake of any public water supply, may be established, until the location of such plant, including plans for disposal of the wastes, have been approved by the State Board of Health.

A new act gives the State Board of Health much larger powers for the protection of the waters of the state and of existing public water supplies. The act provides that when official complaint is made to the board that any municipal or other corporation, or person, is discharging sewage or other waste into any stream or body of water, and is thereby creating a nuisance detrimental to health or comfort, or is polluting any public water supply, the board, after investigation, and after a public hearing, may require the introduction or enlargement, if existing, of sewage purification works or such other installations or changes as it may deem necessary to remove the cause of complaint. The board's order to that effect must be carried out within a time to be fixed by the board. It is further provided that when official complaint is made to the board that the public water supply of any city or village is polluted and dangerous to health, the board shall investigate the charges. If substantiated, and if it is found that the sources of pollution cannot well be removed, the board, after a hearing, may order the corporation or person owning or operating the water works to change the source of supply, or to introduce purification works, or to change or enlarge existing purification works, if that will give adequate protection. In both cases the order of the board and the time within which it shall be executed must be approved by the Governor and the Attorney General. It will be noted that in both cases the initiative must be taken by some local authority. In the case of pollution of a stream or lake the complaint must be made by the council or board of health of some city or village, or the commissioners of any county, or trustees of any township. In the case of pollution of a public water supply, the complaint is to be made by the board of health or health officer of any city or village, or 10 per cent. of the electors thereof.

Supplementary to these two sections is another giving the board control of all water and sewage purification plants. The board has recently made a special and extended investigation of all such plants in the state. It was found that many of these, through faults of construction or operation, or both, were giving poor results. An inefficient municipal filter is for the public what the usual household filter is for the family, highly dangerous if the water supply is polluted. To meet this condition the new act provides that whenever the board finds that any water or sewage purification works, on account of incompetent supervision or operation, is inefficient, the board, with the approval of the Governor and Attorney General, may order the owners, or those in charge of such plant, to make such changes in operation within five days as will secure an effluent satisfactory

IV. BIG COTTONWOOD CONDUIT, SALT LAKE CITY, UTAH.
Showing Forms, Track, Cars aud Concrete Mixer.

to the board. If they fail in doing this, then the board may require them, within ten days, to appoint, with the approval of the board, a competent person, and pay his salary, who shall take charge of the plant and operate it until results satisfactory to the board are obtained.

It has been found in our state that the limit of permissible bonded indebtedness of municipalities has been the most serious obstacle in securing water and sewage purification plants. Especially is this true as regards sewage disposal plants, as such plants are not usually for the direct benefit of those who have to pay for them. A large number of our cities and villages have about reached their bond limit in payment of other municipal improvements, and when asked to introduce needed water or sewage purification works, have been able to reply that it was legally impossible under the bond limit. To meet this it is provided that municipalities, for carrying out the provisions of the act, may exceed their bond limit already provided by 5 per cent. of the total value of all property listed for taxation. It is made the duty of all municipal officers who have to do with the raising of tax levies, to provide, within the limit named, for such sums as may be necessary to carry out the orders of the State Board of Health for the purposes mentioned.

The arbitration clause of the act should be referred to. When the bill, which did not include this clause, was introduced, it raised a storm of opposition from municipal officers, which seemed likely to defeat it. This was almost wholly removed by providing for arbitration. If the orders of the State Board of Health, after approval by the Governor and Attorney General, are not satisfactory, they are to be submitted to two experienced sanitary engineers, one chosen by the board and one by the corporation or person affected. If they do not agree, they choose a third. They may affirm, modify or reject any order, and their findings must be accepted by the board and be enforced in the same manner as an original order. The expense of arbitration is divided equally between the state and those requesting such reference.

A penalty of $500 is provided for the failure or refusal of any person to perform any duty required of him by the act. This would include the mayor, members of council, city solicitor, and all boards or officials in charge of or responsible for either water or sewage works.

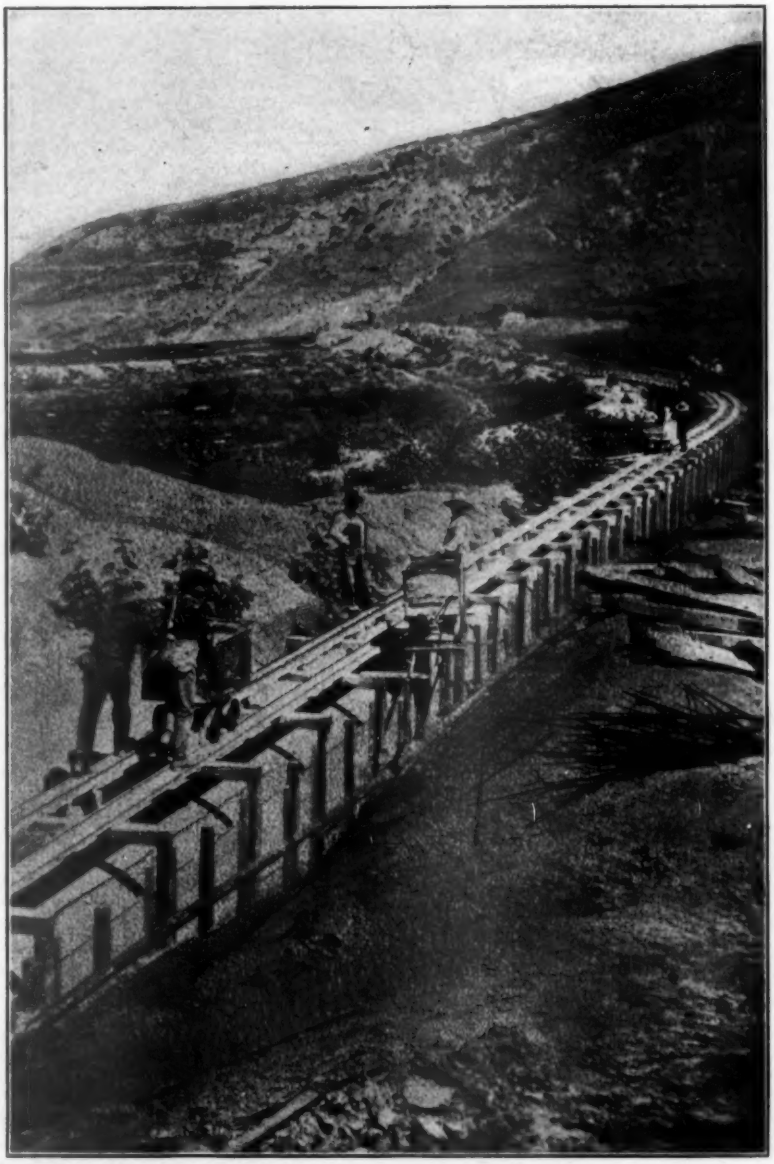
The act may be enforced by the Attorney General bringing suit at the state capital, thus avoiding a local jury. The Governor and Attorney General may, however, remit all or a part of the penalty upon good and sufficient cause being shown.

It remains to be seen what results will follow the proper enforcement of this act. One further step should be taken to give the state full control. No municipality, corporation or person should be permitted to place anything of an injurious character into any stream or body of water that is being made use of for a public water supply, without the approval of the State Board of Health, and that board should have a sufficient number of inspectors to keep all sources of supply under close supervision.

THE DEPARTMENT OF LEGISLATIVE REFERENCE OF BALTIMORE.

By Horace E. Flack, Executive, Baltimore, Md.

At the session of the Maryland Legislature in 1906 there was passed an act creating the Department of Legislative Reference of Baltimore, to go into operation January 1, 1907. It is a well known fact that the great industrial and commercial organizations keep pace with the problems and requirements of the day. They have experts in all fields, men who gather and compile the kind of material necessary for the successful operation of their particular industries. They know what is being done in other places; they keep in touch with every advance in improved methods and appliances; they know what laws are in force in other states which would affect them. No so with our legislators and officials. As a rule they are



V. BIG COTTONWOOD CONDUIT, SALT LAKE CITY, UTAH.
Showing Forms, Track and Cars for Moving Concrete.

not familiar with what has been done elsewhere; they are not able, therefore, to profit by the experience of other communities.

In the earlier days of our republic it was not essential that the several states and cities should know what laws and experiments were made elsewhere, but the conditions are quite different today, since every section is so closely connected by rail and wire and every community is more or less dependent upon every other. If new problems, great and complex, confront our legislatures on account of the great industrial activity and the growing complexity of social and economic conditions, it may be said that still greater problems confront our city councils and city officials. It has been remarked that it will not be long untill there will practically be but two classes of law-making bodies, the city council and the national Congress. Whether this be true or not, it is unquestionably true that the cities are coming to occupy a more and more important position in the affairs of the country. In 1907, 33 per cent. of the people of the United States resided in cities of over 8,000 inhabitants. In a few decades over one-half of the people will reside in cities. It would seem to follow as a necessary result that the problems of self-government are being the problems of the city government. The present tendency, and a proper one no doubt, is to grant more home rule to the cities. When you consider that the cities of over 25,000 inhabitants spend nearly $470,000,000 annually as against about $185,000,000 on the part of the several states and territories, you can begin to realize the importance of the city government. The indebtedness of the cities is greater than that of the several states and of the Federal government combined.

Much study has been given to city government and city conditions; much has been written as to what the city ought or ought not to do; many experiments have been made and many recommendations for the improvement of city conditions have been submitted by students and societies, notably by the National Municipal League. With few exceptions, however, there has been no determined effort to collect, compile and index this material for the use of the officials who have to decide the great problems which confront every city in the country. It seems more essential that the city officials should have at hand such material and data as would aid them in the succesful operation of the affairs of the city than for an industrial organization or corporation to have data for its use, for the questions which city officials must determine affect all those living in the city.

It is practically impossible for any legislator, however energetic and industrious, however desirious he may be to give his state or city the best possible government and laws, to collect all the data and information on the subject under consideration and to grasp all the facts relating to the complex conditions of modern legislation.

In regard to present conditions, there is, first, a great increase in the complexity of legislation; and secondly, a great many students are making careful studies of the problems which arise, as well as the experiences of other cities and communities, but the means have not been provided for making the results of these studies and experiences of practical use. It is to solve this problem—to bring the results of the experiences of other cities and states into such form as to be easily accessible to city officials, that the Department of Legislative Reference was created.

During the short time in which the department has been in existence an effort has been made to secure copies of the charters and ordinances of other cities and the reports of the several municipal departments. The department also receives the council journals of a number of cities, so that we are able to keep in touch with what is being done elsewhere. We also receive quite a number of municipal journals, so that we keep informed as to any investigations which are made elsewhere, as well as any new experiments which are being tried, and with what results. Books treating of municipal problems and conditions are kept on file, and many clippings are made from newspapers and magazines, the latter material often being of great value, since much of it cannot be gotten in any other way, and if allowed to escape, can hardly be duplicated later. Letters are sent to officials and others making inquiries as to the actual working of any particular law or ordinance, requesting suggestions as to improvements, etc. All these materials, charters, ordinances, reports, books, magazines, clippings and letters are minutely indexed and classified so as to be easily accessible, and, so far as possible, all the material on a particular subject is brought together. To accomplish this it is frequently necessary to tear up reports, books, magazines, etc. It is

VI. BIG COTTONWOOD CONDUIT, SALT LAKE CITY, UTAH.
Showing Completed Section of Conduit.

a great advantage to have the material in compact form, for the average official will not take time to read a whole book or to hunt through a library for what he wants, but he wants everything right together, and the more material we can get together on any special topic, the more valuable it will be for reference work.

All the ordinances passed by the city council since the department has been in operation have been carefully indexed. This is also true of every bill which was introduced in the last session of the Maryland legislature, for the department has not limited its work to providing material for city officials. Quite a number of members of the legislature made use of the department to secure information about subjects which were being considered, and there is every reason to believe that the department will be of greater use in this respect in the future.

It is gratifying to say that the department has been called upon quite frequently by city officials for information in regard to what ordinances were in force in other cities on special subjects, and whether they were successfully enforced, etc. There is every indication that the department will be used more and more by city officials when they realize fully how essential it is that they should know how other cities deal with the same problems which confront them.

Soon after entering upon the duties of the office the following letter was sent to each member of the city council:

Baltimore, January 15, 1907.

Dear Sir:

At the last session of the Maryland legislature there was created for the city of Baltimore a Department of Legislative Reference, which went into operation January 1, 1907. It is the duty of this department to investigate and report upon the laws of this and other states and cities relating to any subject, when so requested by the mayor, any member of the city council or the head of any city department; to collect and index all data obtainable as to the practical operation and effect of such laws, and to investigate and gather all available information relating to any matter which is the subject of proposed legislation by the General Assembly of Maryland or the city council of Baltimore. In other words, it is the purpose of this department to collect and index, so as to be easily accessible to any one, such books, reports, bills, documents and other material as will aid the members of the city government in their official duties.

Some material has already been collected, but you can be of much help to us by indicating the subjects or topics in which you are especially interested and would like to have investigated. We desire to make such material as we have collected or may collect of the utmost use to you and want you to call upon us for any aid we can give.

If you will inform us of any subject or subjects you wish investigated, as far as we can, we will tell you:

1. What cities have passed ordinances on any particular subject.
2. Where resolutions for similar ordinances are under discussion.
3. Where valuable discussions of any subject may be obtained.

We will also try to collect all available data, such as reports, magazine articles, ordinances, laws, statistics, etc., relating to any particular subject.

Kindly let us know if we can serve you in any way. This department is strictly non-political and non-partisan.

A letter somewhat similar to the above was also sent to each member of the legislature a short time before the legislature met.

During the short time we have been at work we have collected 784 books and 2,443 pamphlets, and in addition to this we have a number of duplicates, magazines, clippings, etc., all of which have been very fully catalogued.

While our collection is by no means complete, we believe there are very few municipal subjects on which we haven't at least something. Departments of this kind should be co-operative, and if a number of cities would establish them, the work of each would thereby become more valuable. Milwaukee has recently established a department modeled very closely after this one, and other cities seem to be contemplating such a step. But to be of any value whatever, the department must be entirely divorced from politics, for unless it is non-political and non-partisan, it is likely to be more harmful than useful. The department here is under the control of a board consisting of the mayor, city solicitor, president of the Johns Hopkins University, president of the Municipal Art Society, and the president of the Merchants and Manufacturers' Association, the majority of the board having no connection with the city government.

Albama, California, Indiana, Michigan, Nebraska, North Dakota, New

VII. BIG COTTONWOOD CONDUIT, SALT LAKE CITY, UTAH.
Showing Completed Section of Conduit.

York, Rhode Island and Wisconsin maintain reference departments for their legislatures, and it seems even more important that cities should have such departments.

It seems strange that cities have delayed so long to establish departments of this kind, for there is every reason why each city should desire to profit by the experiences of all the others. In this way thousands of dollars could have been saved which were spent in useless experiments after they had been demonstrated failures elsewhere.

METHODS OF WATER ANALYSIS.*

By J. H. Brewster, Assistant Chemist, State Board of Health, Indianapolis, Ind.

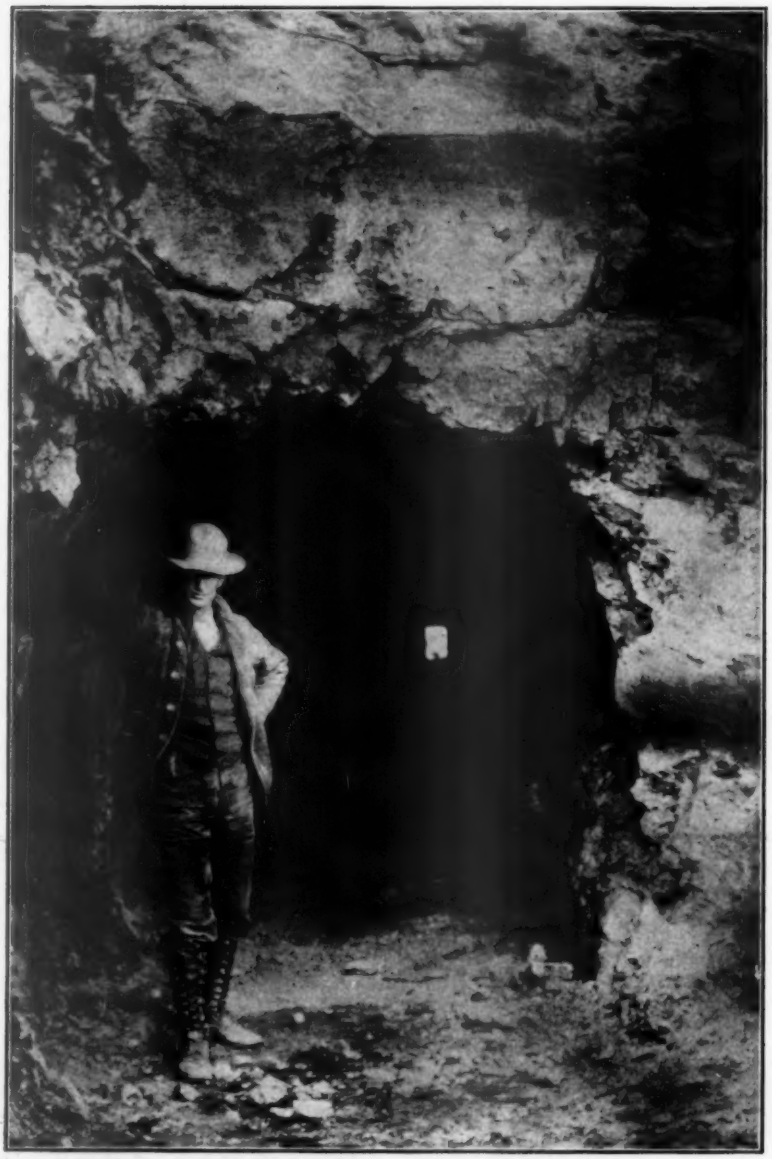
A GREAT deal of popular misconception exists upon the subject of the analysis of potable water, and it is commonly supposed that such an examination may be looked upon from practically the same point of view as the analysis of an iron ore. That this belief is founded on fallacy may, however, be readily shown. When an iron ore is submitted for analysis the chemist determines and reports upon the amount of iron, phosphorus, sulphur, etc., found therein, and at that his duties usually cease, inasmuch as the iron master is ordinarily capable of interpreting the analysis for himself. Even should the analyst be called upon for an opinion as to the quality of the ore, the well-known properties of the several constituents make such a task an easy one, and assuming the sample to have been fairly selected, the opinion may be written without any inquiry as to the nature of the local surroundings of the spot whence the ore was taken.

A water analysis, on the other hand, is really not an analysis at all, properly so called, but is a series of experiments undertaken with a view to assist the judgment in determining the potability of the supply. The methods of conducting these experiments are largely influenced by the individual preferences of the analyst, and are far from being uniform or always capable of comparison, thus often introducing elements of confusion where two or more chemists are employed to analyze the same water. Some of the substances reported—albuminoid ammonia, for instance—do not exist ready formed in the water, and are but the imperfect experimental measures of the objectionable organic constituents, which our present lack of knowledge prevents our estimating directly. Thus the numerical results of a water analysis are not only unintelligible to the general public, but are not always capable of interpretation by a chemist unless he be acquainted with the surroundings of the spot whence the sample was drawn, and be posted as to the analytical methods employed.

It is very common for water to be sent for analysis with the request that an opinion be returned as to its suitability for potable uses, while at the same time all information as to its source is not only not furnished, but is intentionally withheld, with a view of rendering the desired report unprejudiced in character. Such action is not only a reflection upon the moral quality of the chemist, but seriously hampers him in his efforts to formulate an opinion from the analysis. Results which condemn a surface water may be unobjectionable for water from an artesian well, for the reason that in the latter case high figures in free ammonia, chlorine or nitrates are often capable of an explanation other than that of sewage infiltration. Even though such a water should at a previous period have come in contact with objectionable organic waste material, yet the intervening length of time and great distance of underground flow would probably have furnished abundant opportunity for thorough purification. Deep samples taken from the same lake, at the same spot and depth, will vary greatly in analytical results if the temperature of the water at the several dates of sampling should be markedly different, owing to the disturbing influence of vertical currents.

Again, suppose it is desired to determine whether or not the water of a large stream is so contaminated

*From a paper before the Indiana Sanitary and Water Supply Association.



VIII. BIG COTTONWOOD CONDUIT, SALT LAKE CITY, UTAH.
Showing Excavation in Rock Tunnel Ready for Concrete Lining.

with up-stream sewage as to be unfit for a town supply. An analysis of the water taken from the site of the proposed intake would very possibly be valueless, because the enormous dilution to which the admitted sewage would have been subjected would have removed from the analytical results everything of an absolute character. Examinations of any real value in such cases should always be of a comparative nature. Samples should be taken above and below the point of contamination and again at the proposed intake. If the difference between the first and second samples, which is a measure of the pollution, be maintained, or nearly so, at the point of the intake, then the water should be condemned, no matter how completely the analytical results fall within the limits of the so-called standard of organic purity.

Thus it is that a chemist must be in full possession of all the facts concerning the water which he is asked to examine, in order that his opinion as to its purity may be based upon the entire breadth of his past experience, for in no branch of chemical work are experience and good judgment better exercised than in the interpretation of a water analysis. As Nichols has well said, "It is a great mistake to suppose that the proper way to consult a chemist is to send a sample of water in a sealed vessel, with no hint as to its source." On the contrary, the chemist should know as much as possible as to the history and source of the water, and, if possible, should take the sample himself. It was years ago laid down as a golden rule "Never to pass judgment upon a water the history of which is not thoroughly known," and the nearer this maxim is lived up to to-day, the fewer will be the mistakes in the reports issued.

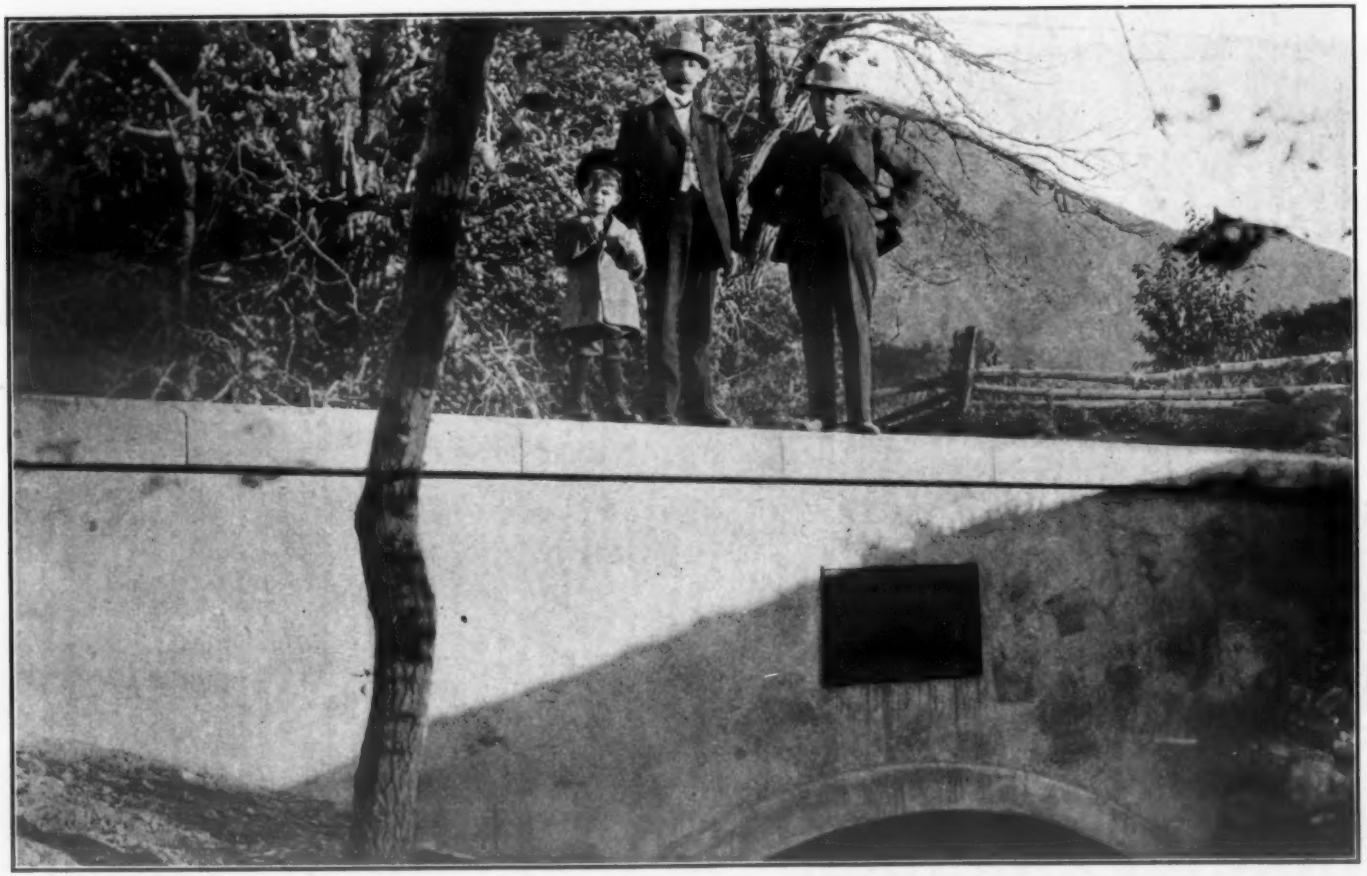
It very frequently becomes the duty of the analyst to answer the question, What can we take as an analytical standard for determining when a water is suitable for drinking and domestic purposes? The city fathers are extremely anxious to have a set of figures that they can put down in black and white on the renewal of a contract with their local water company. The water company is also desirous of a standard in order that they can easily live up to the terms of their contract, and the health officer, who has many different styles of analyses presented to him for interpretation, would also like some definite form to go by.

The speaker has had several requests to disclose at this time the standard by which the State Board of Health determines the purity of a water supply, that it may be adopted by companies and corporations, both private and municipal, so that they can say in times of difficulty, "We will submit ourselves to the state as authority."

Permit me to say that the standard is just this: That the water shall be safe and wholesome, nothing more. A set of figures as a standard in any case is absolutely valueless. There are three distinct divisions in the analysis; one is a careful and thorough sanitary survey; second, a chemical analysis, and third, a bacteriological examination. All of these have their importance, and no two give you a complete knowledge of the situation.

With these data at hand, it now rests with the good judgment of the analyst to determine whether or not it is a potable water. Of course, the presence of bacteria of the colon type is in itself a condemning feature, and high bacterial counts are not desired. If there is a larger amount of chlorine present, together with nitrogen in the form of nitrates, it is quite conclusive of past pollution; high nitrogen in the form of nitrites is a bad indication; and the presence of albuminoid ammonia is quite indicative of undecomposed organic matter.

By a sanitary survey we mean that tne analyst actually goes on the ground and gets a knowledge of the source of the water and of the opportunities for pollution, both constant and occasional, to which it may be exposed. He then looks into the rock stratum and sees if the cleavage and cracks run from the points of pollution toward the water or away from it. He determines the nature of the soil in which the water is located, and together with numerous other points that he discovers, he is not only greatly aided in determining the safety of the water, but it is very essential that he know these things to make it possible for him to properly interpret the analysis. In my judgment it is not too much to say that if but one form of examination be possible, the sanitary survey should be selected. But although, taken alone, I believe the sanitary survey in the majority of cases is the most important form of examination, I beg not to be misunderstood, for no amount of inspection could be substituted for the bacterial count in testing the efficiency of a filter plant.



IX. BIG COTTONWOOD CONDUIT, SALT LAKE CITY, UTAH.
Showing Crossing of Mill Creek on Culvert.

Not only is this examination of the water the most important, but it is positively an essential, and no company should attempt to operate a filter plant without a complete knowledge of what they are supplying their consumers. It should be from a bacterial examination that the coagulant of a mechanical filter is increased and decreased, instead of relying wholly upon the turbidity and color that is in the water. Merely clarifying a water and producing an excellent appearance means absolutely nothing, for it is not the things that you can see in water that are harmful, but it is things that you cannot see, and this very point is the strongest one why the operation of a plant should be entirely under laboratory control. The public place their confidence in the water company to produce a safe and wholesome water, and as long as the water has a good appearance and a good taste there is no complaint to be made, but if the water company simply strains a water and allows a gross amount of the pollution to stay in the water, they are not only disregarding their contract, but they are endangering the health of the people to whom they deliver the water. If laboratory control is not maintained the beds may foul and become breeding grounds for disease-carrying bacteria. It has actually happened that where beds have fouled, the filtered water has contained more bacteria than the unfiltered, and b. coli has been present when they were absent in the raw water. Yet this condition could not be detected from the appearance. Not only is the operator working in the dark, but the unsuspecting public are innocently drinking a heavily polluted water, and public health is of entirely too much importance to take any such risk.

It has been shown that the sanitary survey is needed and that the bacteriological analysis has a place of most importance, but it is none the less true that there are times when both of these are of little value and the chemical analysis is the one to be relied upon. It often happens that a well is so situated that the surroundings are of the best and it is not possible to determine the source of the supply. The bacterial analysis may show good results for the reason that the land lying between the source of pollution and the well is, at the time of examination, filtering the water. But during a rainy season the land becomes overburdened and unfiltered sewage enters the well. Both the sanitary survey and bacterial examination fail to show danger, but the chemical analysis plainly indicates that the well is receiving sewage drainage. At all times is a single chemical analysis of water of much more value than a single bacteriological. In drawing a conclusion it is readily seen that each has its place, and that in the majority of cases each is dependent upon the other.

As there are many methods for doing both chemical and bacteriological work, and also different ways of reporting the same, it has been thought advisable to at this time propose a scheme of analysis, and, if adopted by all who do chemical and bacterial water work, it will make a uniform system that will enable one laboratory to interpret and compare work with another.

The purpose of this paper is not to lay down a rule that every one must follow whether they desire to do so or not, but is simply to put before you a complete scheme which will be open for discussion, and any ideas will be changed that are thought advisable by those present. It is simply to try and make a uniform system throughout the state.

It may seem to some that you will have to change your work considerably, but I will assure you that it will not affect anyone any more than it will the State Board of Health.

The book to be used as a guide will be "Standard Methods of Water Analysis," adopted by the American Public Health Association.

Results of chemical analysis shall be expressed in parts per million. In collecting samples, one gallon ground glass stoppered bottles shall be used for the chemical analysis and two ounce ground glass stoppered bottles for bacteriological samples.

The turbidity shall be done by the silica method adopted by the United States Geological Survey.

The color shall be measured by the platinum-cobalt method.

The odor should always be noticed.

The nitrogen shall be determined as free ammonia, albuminoid ammonia, nitrites and nitrates in the ordinary methods.

The total solids and fixed should be determined.

The iron shall be determined by the use of potassium permanganate for oxidation, and potassium sulpho-cyanide.

The alkalinity shall be determined, making your own choice of indicators, lacmoid erythrosine and methyl or-

ange being entirely satisfactory with the exception of methyl orange in handling the effluent of a mechanical filter where alum is used as a coagulant, as it does not indicate acidity due to alum.

Chlorine shall be determined by the chromate method, with nitrate of silver. If Volhard's process is desired in case of high chlorine, there is no objection, but it is not advisable where the chlorine contents are low.

With the present knowledge of bacteriology there is no method known by which the absolute number of living bacteria in a sample of water can be determined, and all quantitative determinations of bacteria are necessarily of a relative character. This being the case, strict adherence to a standard procedure is of especial importance. The standard medium for determining the number of bacteria shall be nutrient gelatine, to be made as described in "Standard Methods," with the exception that beef extract may be substituted for lean meat. The procedure to be followed is also carefully given, namely: incubation shall be 48 hours, at 20 degrees Centigrade. If the cultures be incubated for more than 48 hours, the time of incubation should always be stated in the reports. The problem of comparing the results of two laboratories as to bacteria is undoubtedly the most difficult problem in water analysis, and for this reason it is very essential that a standard medium be used, that a temperature of 20 degrees C. be kept as nearly as possible, and that the number of hours of incubation be the same in all cases.

The test for bacillus coli is of great importance and shall always be made.

This system of analysis completely carried out by all laboratories in the state, will remove many of the difficulties that arise from the different methods now in use and will also aid greatly in obtaining a complete knowledge of the water throughout the state of Indiana.

THE PUBLIC AND PRIVATE WATER SUPPLIES* OF INDIANAPOLIS.

By Dr. Eugene Buehler, Health Officer, Indianapolis.

I REGRET exceedingly, that it is possible to say anything about the wells of Indianapolis, for had we our way there would be no wells. We have at this time between 18,000 and 20,000 wells in daily use. The majority of these are driven in drift, the average maximum depth being 40 feet. There are about forty deep-rock wells other than those of the water company, located in office buildings and in factories, whose depths range from 300 to 1,000 feet. Of these latter nothing need be said, for, excepting its hardness, the potability of the water is unquestioned.

Of the others I need only say this: That in addition to having a driven well on the premises, they also have a privy vault, usually within 25 feet, and so constructed that it permits the fluid contents to filter into the ground, making frequent cleaning of the vault unnecessary, and when I add to this that the city of Indianapolis has no ordinance compelling sewer connections, nothing further need be said of the possibilities of such a water supply. Leaving out other causative factors, the difficulty of investigating a typhoid fever outbreak will be readily understood.

The question might be asked, why not pass an ordinance prohibiting the use of wells within the city limits. There are reasons why such a law would not be practicable at this time. First, because of the rapid growth of the city. More than nine square miles have been annexed in the past five years, and, there being no water mains, the wells become a necessity. Secondly, there seems to be a deep-rooted sentiment on the part of a number of people that well water is much to be preferred to filtered river water. Whether it has its foundation in the fact that in the summer months the well water is cooler, requiring no icing, or whether there is a real prejudice against the corporation supplying the water, I am unable to say. The fact remains, however, that no amount of persuasion on the part of the de-

*From a paper before the Indiana Sanitary and Water Supply Association.

partment that the public supply is above suspicion seems to prevail with this class. There is another side to the question. If the public supply were under municipal control, and not owned by a private corporation, there would be a possibility of having a law passed to close the wells, but as it now stands, whenever a well is condemned, some of the owners at least believe that it is done in order to give the company another contract.

Last year 922 wells were examined and 428 were condemned. We examine only such wells as are reported to us for examination or from premises which have been reported for typhoid fever or other sickness. There can be no doubt that many of the wells now in use are polluted and should be closed. However, there is no systematic effort made to close wells, and there are every year new wells sunk, a prominent well driver estimating the number between 900 and 1,000.

Now, as to the methods employed in the examination of well water. It is the practice at present, and has been in the past, to classify the wells as follows:

Class 1. Water strictly potable, containing three parts of chlorine or less per 100,000, and no nitrites.

Class 2. Water considered as potable, either because it is rainwater or from a sparsely or recently settled district, or a deep well, or because it is beyond the reach of pollution from its location, such water containing less than five parts of chlorine, and nitrites not more than a faint trace.

Class 3. Water on which judgment is suspended because the pollution is suspected to be due to temporary causes or to causes other than pollution of the veins of water. Chlorine may be present in excess, but no nitrites, or conversely, nitrites may be present, but no excess of chlorine.

Class 4. Water polluted somewhat, but not extremely bad. Chlorine, seven parts or less and not more than traces of nitrites.

Class 5. Hopelessly polluted water from shallow or dug wells. Chlorine, over seven parts and excess of nitrites, or chlorine over eleven parts whether nitrites are present or not, or even great excess of nitrites in the absence of excess of chlorine.

The rules for the above water classifications are: Classes 1 and 2 are not sealed. Class 3, not to be sealed after first examination, but to be re-examined in two weeks after the first sample is taken, and then judgment exercised accordingly. Class 4, to be sealed at once, and a second sample to be taken in thirty days, acting according to the second analysis whether or not the well is to remain sealed. Class 5 shall be sealed at once, and this is to be final and no re-examination ordered.

The board's normal standard of purity is not over three parts chlorine per 100,000 and not more than a faint trace of nitrites. Any evidence of dangerous proximity of vault, cesspool or other source of danger to be considered before condemning the water supply. We realize that this is an arbitrary classification and not a scientific procedure, and is successful only because it has not been seriously questioned. It seems to me there should be some uniform method of well water analysis and a fixed standard of purity established, if that be possible, for leaving out city wells entirely, we are often called upon to determine the purity of wells on dairy farms, which are important factors in tne production of a pure milk supply.

Of the public supply, there are those present who are better able to speak than I. I will say, however, that we are making daily bacteriological and chemical analyses. The water is taken from public fountains located in seven different parts of the city, and it has been found uniformly good, the filter efficiency being not less than 96 per cent.

In addition to examining the public and well water supply, we have been making daily bacterial examinations of the principal bottled waters sold in the city, and in this connection an interesting condition was found. A comparison of the bottled and city water shows that the bacterial count of the city water has been uniformly lower, and that in one particular brand of bottled water the count has reached as high as 4,000 colonies per 1 cc.

In closing I would like to add that I hope from this meeting some definite steps will be taken to establish uniform methods of procedure and to determine, if possible, the limits of safety in municipal water supplies. In other words, what the health officers require is some definite standard upon which to base a correct opinion as to the potability, not only of the well water, but also of the municipal water supplies.

EDITORIAL COMMENT

Plans for City Government.

Concrete and Brick.

PLANS FOR CITY GOVERNMENT.

This is the day of plans for city government. Each one is developed by some public spirited or otherwise interested citizen with or without aid of others, to meet certain local conditions, or is based on some plan previously adopted by some other city with such modifications as the differences in local conditions seem to demand. If the legislature is complaisant the charters proposed are granted and the experiment begins.

Perhaps the nearest approach to the letter of this program is found in Texas. The Galveston plan arose from the needs of that city after the great storm, and has thus far been quite successful. Now the Houston plan is in operation and shows some modifications which may or may not be improvements.

Perhaps the Des Moines plan may have grown out of the consideration of the Galveston plan, but it differs materially in principle as well as in detail.

Then there is the Newport plan which again is radically different.

In New York the plans of city government have usually been forced upon the city of New York, but the smaller cities of the state have had more consideration, although there has been some of the same forcing process, since charters intended for particular cities have been applied to all cities of the same class.

What may now perhaps be called the Indiana plan was originally the Indianapolis plan, and was developed originally to meet the need of a law which would enable the city to begin the remarkable series of improvements which since 1891 have made the city a model in many respects. Advantage was taken of the strong sentiment in favor of material changes in the city's form of government to present a full and well considered plan of control of tne city which would properly coordinate the legislative, executive and judicial branches of its government. This plan has operated so well that it has been gradually extended, with modifications, to others of the larger cities of the state, and recently all these laws were codified and the cities were classified and the plan was applied to all cities and towns, with such modifications for the five classes of cities and the towns as would provide for the necessary differences in conditions, arising mainly from differences in size. Thus what originated in a practical grant of a certain amount of home rule in the capital city of the state, since the first of these charters was developed and presented by its citizens, has become a law fixing the courses of procedure in all the cities and towns of the state, whether they desire to follow these forms or not.

The writer likes to consider the municipality as a business corporation formed to do certain things for its stockholders, the taxpayers, and certain other persons who have considerable importance because they can vote for the officers of the corporation although they do not contribute to its support. Business corporations are in principle creatures of the state, and so are municipal corporations. The principal difference in treatment of them in the past has been that the business corporations were allowed the extreme of "home-rule" and had practically no restrictions while, except in certain times and places for political reasons, the municipalities have been allowed a minimum of home-rule and have often had very obnoxious forms of state control thrust upon them.

History shows that the state is beginning to recognize its duties with

respect to the control of business corporations, mainly thus far with respect to what are called public service corporations, and some of the states have made more or less successful experiments in exerting their unquestionable right to such control, according to the correctness of the principles upon which the controlling laws are based and the honesty, efficiency and freedom from political control of the ofcial boards put in charge of the enforcement of these laws.

There are some faint indications of a tendency to relax the control of municipal corporations in some directions, allowing them a greater part in their own government. This tendency is not yet very pronounced, mainly, no doubt, because the inefficiency of municipal officials, due to the conditions arising from the long existing methods of state control and of selection of officials, has made legislatures doubtful of the safety of allowing cities any greater measure of self control than they now possess.

There are two lines of progess which promise rapid advance in the right direction for both business and municipal corporations, and ultimate approach to such equality in standing before the state as the necessary differences in the character of their business and the selection of their controlling officials require.

One of these is the control of public service corporations by such laws as those in operation in Massachusetts, New York and Wisconsin. Under one or more of these laws the right of the company to do business, amount of capital, the return upon that capital, the rates charged to secure that return, the quality of the service, are regulated by the state board. This control is assumed by the state over the public service corporations because they operate monopolies under grants from the state or the creatures of the state, such as cities, towns, counties, etc., but the state has equal right to control the operation of any of the business corporations which obtain their right to do business from the state and ask the public to invest in their stocks. This control is also extended to public service industries operated by municipalities.

In Ohio the state has assumed a certain control over the operations of municipalities by the establishment of an auditing department and a system of uniform accounts and reports, so that municipal accounts of many sorts shall become public and the correctness of expenditures and accuracy of accounts and settlements shall be subject to control by a central expert controlling office. This law does not interfere in the least with "home rule;" it will simply guarantee that the accounting officials shall perform their duties according to law, whether state-made or city-made, and that their financial settlements shall be accurate and complete.

These two classes of laws suggest the lines in which the state can most successfully exert its control. The principal difficulties in the practical operation of the municipal machinery, leaving out of consideration the larger questions, are the ignorance of municipal officials concerning their duties, on account of the present methods of selection and their brief tenure of office, the inexpert financiering of the ordinary city council, and the lack of checks upon financial and other operations, with consequent waste of money, even when there is no question of dishonesty.

The control of all the financial operations of a community by an expert body on the same principle as the control of public service industries in a few states and the establishment of an auditing system such as that foreshadowed by the Ohio law, will put the actual financial operations under a similar expert supervision. Such a system would no more interfere with the desires of the city to perform certain operations than the control over Massachusetts lighting companies by the state interferes with the operations of the plant. It would prevent the issue of bonds before the work for which they are to pay is designed and made definite; the transfer of money from one fund to another where it can be spent with less inquiry as to its proper disposition; the making of appropriations which there is no

money to meet, with the consequent stoppage of work at an inopportune time; the passage of appropriation ordinances for purposes which will not bear publicity; and the thousand and one other misappropriations of funds due to ignorance or dishonesty. Some of its good work will be due to the advice of the experts, giving the city officials information to decrease their ignorance; part of it will be due to the fact that the amount and destination of the expenditures will be published.

Legislatures are slow to recognize that these are the proper lines in which to exercise the state's rights of control, and that when expert advice, assistance and control of the details of financial operations is supplied by the state, the municipality can be trusted to take the actual work of city government largely into its own hands.

CONCRETE AND BRICK.

Certain of the trade papers in the cement and brick fields are amusing their contemporaries and such of the observing public as may chance to see their productions, by the fierce attacks which they are making on each other's materials. They were led by the lurid and picturesque writing of one F. W. Fitzpatrick, a consulting architect, who has long had a bad case of "cementophobia." Some of the cement papers, which are none too solid in their technical departments, have been trying to answer the arguments of the brick men and to find examples of brick failures to offset the cement and concrete failures so gleefully put forward by the brick and tile journals. This tempest in a teapot has no appparent effect upon the progress of concrete, the use of which is extending into new fields every day, as well as expanding in fields already entered.

The facts are that there are equally serious and equally inexcusable failures in the use of both materials. Brick has been in use longer than concrete and the methods of using it should be better understood. Probably the ratio of failures in brick construction is less than in concrete construction, due in part to the more imperfect understanding by the ordinary building contractor, and the ordinary architect, for that matter, of the newer material, and in part to the lack of proper building regulations and expert supervision by building inspection departments of concrete construction. Most of the failures in brick structures are due to bad materials and careless construction, but occasionally one is found which is due to the character of the material. Thus a fire in one brick building which came under the observation of the writer caused the collapse of the whole building, although the extent of the fire was small, through the tipping over of the wall of the upper story by falling roof girders, and subsequent crushing of an adjacent roof and skidding back of the brick against the lower portion of the wall, which then gave way from end to end like a row of bricks set up on end. This was a mechanical result, following the action of the fire, but not due to it, except for the cause of its beginning. A reinforced concrete wall would have acted as a unit and would have been able to resist the initial thrust of the roof girders.

But this article is not intended to enter the lists, but merely to call attention to the futility of the calling of names and to suggest that both sides will find that they are advancing their own causes most effectively by recognizing the good qualities of the other building materials and acknowledging the shortcomings of their own. Combination is always better than contest, especially when each has its own particular field, and only in special cases will one interfere with the other. The fight should be made against misuse of the materials, where it can produce results.

In this connection the following extract from an article by J. J. Moroney, in *Brick*, will be of interest:

"The average man's idea of brick-making, where he knows anything at all about it, is based on his knowledge of the old-fashioned open yard, where he may have seen, in his childhood days, the tempering wheel, soak pits, and hand-molding gang, and the brick

drying in the sun. Of modern brickmaking and the up-to-date brick factory absolutely nothing seems to be generally known.

"The concrete industry, though only a few years old, and an infant beside the brick industry, is much better known. The average business man is familiar to a certain extent with concrete construction, both reinforced and concrete block. One reason for this, undoubtedly, is that concrete has received much more publicity in the papers and magazines; but another reason is that concrete is frequently mixed right on the public streets under the direct observation of the average man; while brick yards are located outside of the beaten track, usually outside of the city limits, and brickmakers are notoriously poor advertisers in their local papers.

"Are we not injuring ourselves and our industry by being too modest, and hiding our light so long under a bushel? Ought we not to come out into the open? My idea of a publicity campaign, however, is not the 'knocking' of our competitors and showing up their weak points, as I don't believe in selling machinery that way, but on its own merits. I do believe, however, that it would be greatly to our advantage, as an industry, to educate the general public in the different methods of making brick, the different qualities of brick made, and the different uses that brick can be put to, so as to make them better judges of brick themselves, and less liable to be carried away by some new but inferior building material, which is widely advertised. A brick is a brick, and the best of all building materials, whether made by the soft-mud, the stiff-mud or the dry-press process, or last, but not least, by the sand-lime process, which has found its place in the brick trade, and is here to stay."

Such an article as this does much to counteract the effect of the rabid anonymous attacks on concrete appearing in the same journal, which, by their evident bias and unfairness really react upon the material which they attempt to defend.

THE QUESTION DEPARTMENT

Law Regarding Abolition of Grade Crossings.

I understand Indiana has a good law on the subject of abolition of grade crossings in cities. Can you give me the provisions of the law? M. G., Erie, Pa.

Two laws were passed by the legislature of 1905 which are similar in principle but quite different in practice. One of these applies to the city of Indianapolis with over 200,000 population and the other to the city of Fort Wayne with about 45,000 population.

Following are the principal provisions of the Indianapolis law:

1. The board of public works may adopt resolutions for alteration of any grade crossings, and shall publish for 2 weeks once a week in a daily newspaper notice of time of hearing. Ten days written notice shall also be served on resident agents of railroads affected and county commissioners, but failure to serve notice shall not invalidate proceedings. Plans may be prepared by city engineer, with specifications and estimates, and no grade greater than 1 in 100 shall be provided except by consent of railroad.

2. Expenses shall include raising or lowering grade of street or alley, pavement including sidewalks, alteration and construction of drains, damages on account of changes, cost of elevation or depression of tracks, except cost of ties, ballast, and rails of steam and street railway tracks and cost of relaying and reconstructing them, and includes also portion of $4000 a year to be paid city engineer for engineering services in proportion to time consumed by the said improvement. Steam railroads shall pay 75 per cent of cost, street railway, if any at the crossing, 5 per cent, city 14 per

cent, county 6 per cent. If there is no street railway, city pays 17 per cent and county 8 per cent. The 5 per cent payable by the street railway is computed on the cost for 200 feet each way from center of street crossed. Any one who has already agreed to elevate or depress tracks will do so without reference to this act. If more than one railroad is affected, the 75 per cent will be distributed between them.

3. Railroads and board of public works may make written agreement which will then be the basis of proceedings, but it must be within the terms of the law.

4. Board of public works shall allot the work to the railroads, the city, the street railway, any one or more of them, and fix time for beginning and completion, shall employ inspectors at not more than $65 a month and a clerk at $1200 or less and may pay city engineer $4000 or less, in addition to his regular salary, out of which he must pay his necessary assistants. Board determines necessity of work but appeal may be taken to superior court within 15 days, where board's finding may be modified or confirmed in whole or in part and there is no further appeal.

5. Opening, change, and vacation of streets shall be provided for by board, who also shall determine damages by the work. Written notices of amounts awarded and date of hearing shall be delivered to owners and decision of board is final unless appeal is taken to superior court in 20 days.

6. Work shall be constructed to approval of board and city engineer, who shall inspect the work. On completion, board shall apportion total cost of work between parties interested, subject to appeal to superior court, whose decision shall be final. City comptroller can draw warrants for city's portion without appropriation by council, but council shall levy a tax of not more than 4 cents on $100 valuation on estimate of city comptroller, in addition to present authorized annual levy. County auditor can do likewise, county council being required to insert necessary amount in annual levy. City and county can issue bonds to pay their shares. Railroads, steam and street, shall pay their parts as ordered or they will be placed on tax duplicate and collected as are special assessments.

7. Incorporated town within city must pay its share.

8. When $400,000 expenditure has been ordered in any one year, no further resolutions shall be passed for one year from date of latest, except that by resolution or contract with the railroads an improvement can be ordered in excess, provided the certificates of indebtedness are so arranged that not more than $400,000 comes due in any one year, and no new improvement can be ordered until all these certificates are paid.

9. This act is supplemental to previous acts on the subject and does not repeal them.

This act is based on a contract for one street crossing, negotiated by the city with the railroads before the city had any authority to enforce the construction, and its administration is intrusted to the board of public works of the city.

The Fort Wayne act passes by the regular city government and puts the administration into the hands of a commission appointed by the circuit court and acting under its direct instructions and supervision. Otherwise than the necessary differences in machinery the act is not materially different in principle from the Indianapolis law, although it is much more detailed in its treatment.

1. Council may by two-thirds vote declare necessity of grade crossing abolition, when the city shall have power to institute proceedings in the local circut court for the abolition of crossings by raising or depressing tracks, by viaducts, by subways or tunnels, or combinations of these methods. The ordinance may be general in its terms or have such particularity as the council may desire.

2. The petition of the city to the court is directed against the steam railroads, street railroads crossing the railroads on the streets affected, and owners of real estate that may be taken for or injured by the improvement, and notice of hearing of the petition by the court must be given to them.

3. The service of the notice gives the court jurisdiction of the parties and their property for the purposes of the proceedings, and objections to them must be presented in writing by way of answer. The court tries the issues involved, without a jury, and may call for evidence from the parties interested and independently, and order drawings and plans.

4. After hearing the court decides upon the necessity of the improvement for public safety, health, convenience or welfare. If adverse, the city pays costs and suit is dismissed. If in favor of the petition, the court's decision sets forth complete plans and specifications and appoints three commissioners, at least one a competent engineer, who give bonds.

5. At a time fixed by the court the commissioners must report:

a. Allotment of work to railroads affected, including bridges over and retaining walls adjoining streets crossing tracks and portions of viaducts, tunnels or subways within the boundary lines of the railroad property, but not the approaches outside those lines, with estimate of cost for each railroad.

b. Description of other work necessary for full completion of improvement, including changes of grade, gutters, sewers or other features of construction and detailed estimates of cost.

c. Description of private, not affected

railroad, property required for the improvement, name of owner and appraisement of value.

d. Description of like private property damaged by the construction, with assessment of damages to each parcel and name of owner.

e. Estimate and assessment of special benefits to street or interurban railroads in addition to the general benefit common to all property owners in the city, which assessments shall be paid to the commissioners as the court may order, and shall not exceed one-fourth the total cost to the city of the improvement at the crossings where such street railroads are affected, and not include any retaining wall or superstructure supporting the steam railroad tracks within their right of way nor any new sewer made necessary outside the limits of the changes of grade in the streets affected. The annual proportion paid must be the same as that paid by the city.

6. Within thirty days after filing this report is considered by the court and objections are heard, twenty-one days' notice by daily publication for that time in a city newspaper being required. The notice gives names of owners and description of property awarded damages.

7. Objections by persons interested or affected are heard without a jury, except objections to amount of damages awarded by commissioners for taking and injuring land, which may have jury trial if demanded. Each objector may demand separate hearing and make separate appeal. Objections to damages are heard as speedily as possible.

8. After hearing, the court approves the report of commissioners in whole or in part, amends it or recommits with instructions for making a new report, which goes through the same procedure as the first report.

9. On final acceptance of report the court enters a decree describing the work to be done by each railroad company and fixes time for completion; names lands to be taken and damaged by the work and payments to be made therefor; describes work to be done by the city and determines the miscellaneous expenses for taking or injuring property assessed in favor of property owners. This is a preliminary decree and is followed by a final corrected decree on completion of the work, for the purposes of which the court may order the commissioners to make reappraisements and new assessments.

10. Appeal may be made from the preliminary decree to the supreme court of the state, in case new trial is denied, but no appeal upon questions of damages for taking or injuring property shall delay the improvement. Appeal must be taken within six months unless court extends time six months longer.

11. The court requires of the city a statement of its finances, assessed valuation, bonded and floating indebtedness, cash on hand or in sight within a year, not otherwise pledged, and available for grade crossing elimination, rate of taxation for past two years, and anything else desired.

12. If the city does not have the necessary funds for the work in sight, the court orders the mayor and common council to levy a tax to pay the city's share within seven years, but not to exceed 25 cents on $100 valuation per year. Failure of the officials to obey the order renders them liable for contempt, or the court may order the levy put on the tax duplicate directly, to be collected and disbursed under order of the court.

13. The city may create a special "street and railroads crossings fund" and levy a special tax not exceeding 25 cents a year for use only on the improvements covered by the act.

14. As soon as practicable the commissioners will do the work not assigned the railroad companies by contract as a whole or in parts, as approved by the court, let to the lowest and best bidders, who agree to accept such proportion of cash for the work as the commissioners can pay and certificates of the commissioners for the remainder. Contractors are bonded, and contracts and bonds must be approved by court.

15. Commissioners report to court at intervals and receive its instructions. Court is always open for these proceedings, by judge in chambers if court is in vacation.

16. Estimates are made from time to time and contractors are paid, less 10 per cent. held, until final completion of contract. If cash is not on hand, certificate of amount due is issued and bears 6 per cent. from date until funds are on hand to pay it. Court's approval of certificates is certified on them by the clerk under seal.

17. Proceedings remain open on docket until final hearing on ten days' daily published notice, when court may hear and call witnesses and fix cost deemed proper on each railroad company for work done by it, total cost of work done by commissioners, sums paid for land and damages, and all expenses deemed chargeable to the improvement, thus determining total cost of improvement, which shall be apportioned to the railroad companies and the city as the court may deem equitable within the limits of the law; i. e., the city will pay nothing for work outside city limits, such work being paid for by railroads; the aggregate paid by all the steam railroads affected at a crossing must be between 64 to 65 per cent. of the total cost within the city limits, to be apportioned between them, if more than one, as the court directs; damages to railroad property will not be paid by city, but borne by railroads, in addition to above described assessment. Commission-

ers must make their final report of work done by them at least ten days before the final hearing.

18. If the preliminary decree assigned work to either railroad or city costing more than its share, as determined by the final decree, it shall be reimbursed by the parties favored in the first decree.

19. Within ten days after date of final decree any railroad may ask for new trial on ground of inequality or inequitableness of assessment, and on refusal may appeal to state supreme court within sixty days.

20. If the city has insufficient funds to meet the requirements of the final decree the court has power to continue the levy of taxes until all payments due from the city are made.

21. If, during the progress of the work, the court shall deem it inadvisable to proceed further until the city has more money on hand to pay its portion of the cost, it may postpone the work until enough money has accumulated from tax levy and then order resumption.

22. When all work is done, all bills are paid and all incidental expenses are apportioned and fully paid, and not before, the proceedings are discontinued on the docket of the court, and the power of the court over tax levy continues until that time. Any money remaining unexpended from the special tax is turned into the general fund of the city.

23. If the court deems it inadvisable to enter upon the whole plan of changes of grade crossings at once, it can order such part as he deems necessary to be done in advance of the remainder. In such case the railroads shall present plans for this part, which may be adopted, modified or rejected and substitute ordered by the court. Such proceeding upon the part to be constructed will then continue as described in previous sections, and shall be considered as a part of the whole, the court being vested with large discretion as to details, but no railroad shall be required to maintain permanently within the city a gradient greater than 0.75 per cent. for a distance greater than 800 feet.

24. If it is discovered at any time that the assignment of work to railroads and city requires one or more to pay more than its share, the court may order the favored party to pay over to the other such sums as are practicable to equalize the payments as nearly as may be until the final decree.

25. The court can open new streets, vacate old ones across the railroads for the purposes of the improvement, and all such changes are referred to the commissioners for assessments of benefits and injuries under the general procedure followed by the city itself in such cases.

26. The court may order removal of telegraph or telephone poles at the expense of company owning them, on the streets affected by the improvement.

27. Presence on elevated tracks of any person not an employe is trespass, subject to $25 fine.

28. This act is supplementary and cumulative to any previous law and does not repeal any existing statutes.

Dust Prevention by Chemicals.

Will you kindly inform us whether hygroscopic salts, such as calcium chloride, magnesium chloride, or others, are being used or have been used in the United States for sprinkling roads and streets to lay the dust. If you know of any, please inform us where and to whom we could write to get some details. Also can you tell us as to their use in foreign countries, for dust laying purposes? Can you refer us to any literature upon the subject? Also, what satisfaction has the employment of hygroscopic salts given for dust laying purposes?

ROGERS CHEMICAL CO.
San Francisco, Cal.

At the last meeting of the Massachusetts Highway Association Wm. D. Sohier of Beverly, Mass., referred to the success of calcium chloride as a dust layer. B. P. Richardson, president of the company doing the work, described that done at Beverly Farms, where 9.69 miles of road, having 108,013 square yards area, were treated for 5 months. The road is 19 feet wide and the traffic is heavy with a majority of the vehicles rapid moving automobiles, 692 automobiles out of 1182 vehicles in 10 hours. By the patented method of applying the material it was claimed that the total cost of treatment for a seven months season was 3.5 to 4 cents a square yard, including the cost of the chemical, as compared with 2.4 cents for water alone, and the result is better.

At Hingham, Mass., it is reported that the treatment with calcium chloride is cheaper than sprinkling with water, as well as better.

John R. Rablin, chief engineer of the Metropolitan Park Commission, Boston, Mass., states his opinion that calcium chloride treatment is a good substitute for sprinkling and costs less. It requires fresh applications every few weeks and must be renewed each season. It is cheap and easy of application.

A test of calcium chloride was made by the U. S. Department of Agriculture on a road in the Government grounds at Washington concerning which information will probably be published. Meantion will be found on another page. The first applications were made in July, 1907, on a road made of trap rock, repaired with limestone and again repaired with trap rock. Under traffic the limestone was ground to powder and the surface failed to bind until the calcium chloride was applied, when the road is said to have become very satisfactory in condition. Two or three additional applications were made during the summer.

More attention has been paid in England to this method of laying dust and there are several companies there which

use chloride of calcium or other chemicals the nature of which they retain as trade secrets, but which have similar effects, such as Brunner, Mond & Co. and the Akonia Syndicate.

The city engineer of Nottingham, England, in a discussion of "Present-Day Road Requirements in Town and Country" gives the following regarding the use of calcium chloride for alleviating the dust nuisance:

"Various oil preparations have been tried, with only moderate success, and have given place to materials of which calcium chloride is the principal ingredient. It has been known for years that street watering with sea water is more effective than watering with the town water supply; after the water has evaporated, the particles of sea salt, which is really sodium chloride, remain; this is a deliquescent body, always taking up moisture from the air and remaining damp. Calcium chloride is a saline body, much like sodium chloride, but is more deliquescent, as, if some of the calcium chloride is exposed to the air for a short time, it attracts so much moisture from the air that it rapidly becomes a liquid. It is a by-product at the large chemical works and is produced in enormous quantities, and it ought to be sold more cheaply than it is, the present price being about 30s. per ton, plus carriage. It is applied in the usual way by means of a water cart, the first dressing is a 10 per cent solution, and the second a 5 per cent solution. After the evaporation of the water, which is simply the medium by which the calcium chloride is applied to the road, the crystals of the calcium chloride are left on the surface of the road and attract moisture from the air and keep the surface of the road damp. Curiously, the greatest enemy of any oil process or calcium chloride mixture for laying dust is heavy rain; the latter washes the oil or calcium chloride from the surface of the road into the channels, and the process of treating the surface has to be repeated.

"I have found calcium chloride very effective, and its great advantage over ordinary street watering is that it ensures a road with freedom from dust for twenty-four hours a day for seven days a week. A road requires treating about once a month, although this depends a good deal upon the amount of the traffic. The cost of treating roads with calcium chloride is about 25 per cent less than ordinary street watering, but the comparison is hardly fair to calcium chloride for the reasons given above."

Calcium and magnesium chlorides were first proposed for treatment of dusty roads in England in 1856 and a patent on the use of sodium chloride together with some more deliquescent chloride, such as that of calcium or magnesium was issued in England in 1867, long enough ago to have expired.

The latest edition of Byrne's "Highway Construction" ($5) is the only text book treating at any length of dust prevention. Its attention is paid mainly to oil and tar and the treatment of roads with chemicals is restricted to statements of the materials used and brief descriptions of methods of applying them.

Areaways Under Sidewalks.

In the numerous improvements in progress in this city throughout our business district, in the erection of new buildings and the remodeling of old buildings, the question of the use of areas under sidewalks has occasioned some difference of opinion. Property owners in some instances insist on constructing their retaining wall with the inside face of the wall flush with the inside of the curb; this location interferes with telephone, electric and trolley poles, fire hydrants, curb boxes and catch basin inlets and other public utilities; where streets have been previously paved some difficulty is experienced in back filling under concrete foundation under curb. It occurs to the writer that area retaining walls should not extend into the street or approach the curb closer than 3 feet back from face of curb. Will you kindly advise me regarding the proper location for area walls and the use of such areas in general?

C. W. SWEARINGEN,
City Engineer Great Falls, Mont.

This question was discussed in this department in vol. xxxiii, p. 184. It is most probable that cities in Montana have control of the area under the sidewalks and the city council can make such regulations regarding their use as it may deem proper. If the building lots are sold by numbers from a plat the lot owners probably have only right of way over the area between the street lines, even in states where the lot owners are required to construct and maintain their own sidewalks. They also have the right to use of street and sidewalk underground for water, gas, steam and sewer pipes, conduits and the like, all subject to the regulations of the city government. Under the general rights given to the city council in the city charter there should be a clause giving that body the right to regulate the use of sidewalks and all structures in, under or over them. Even if this clause does not exist, the council is most probably vested with the power, under the general clauses covering its rights and duties. Even in the states where the ownership of property extends to the middle of the street this control of sidewalks is doubtless in the hands of the council.

The question then reduces to the character of the control to be exercised by the city. If the council deems it desirable to make a general regulation such rule should cover all the possible contingencies and all plans for the use of areaways should be referred to the city engineer for approval, as well as to the building inspector. There is so much difference in local conditions that there

must be many exceptions even to the most general rule. Considerable discretion should be given the city engineer, therefore. Where there are poles the problem has some difficulties and the property owners should probably be required to provide for the setting of permanent poles under the supervision of the city engineer in such manner as to make them safe and as sightly as possible. The property owner should also be required to provide for the setting of sewer inlets, resetting hydrants and the like, and in case any sewers, pipes or conduits are placed under the sidewalk he should be required to leave room for them and pay for whatever reconstruction is necessary. All these things are taken care of in connection with areaways under sidewalks and usually they should be at the expense of the property owner using the space under the sidewalk. This space is of value to him, in many cities does not belong to him, and in most cities is subject to use and control by the city. If the space is of sufficient value to him to make it worth his while to pay what may be necessary to secure it, and the structure he puts in is built according to the city's regulations, so that it will not interfere with legitimate and licensed uses of the street and sidewalk, present or future, there is no serious objection to permitting him to use it. It is evident, however, that this use and the construction and maintenance of the structure necessary for it should be under the direct and continuous control of the city through its proper officer, preferably the city engineer, under a city ordinance giving him such general directions as the local circumstances suggest, and full discretion under their terms. The placing of the area wall three feet back of the curb would probably be a very satisfactory general regulation, but exceptions might arise. Street pavements are sometimes widened when traffic conditions change and curbs set back more than three feet, so that a permit should not be stated in absolute terms. A license requiring annual or other periodical renewal with a fee or rental would keep the case open for change with changed conditions in this respect or any other.

If there is any prospect of locating pipes or conduits under the areas between curbs and property lines, the city's policy in regard thereto should be settled and placed on record before the question of areaways is settled. The large cities find it practically impossible to instal the pipe and sewer galleries and conduits which would relieve their troubles, because of the extension under the sidewalks of the basements and sub-basements of buildings. The smaller cities can take warning from the experience of their larger sisters.

Reference should be made to the article referred to above for some further light on the subject.

The city's building ordinance should take care of the design and strength of walls and arches or other coverings required and the city engineer should have the decision regarding their location with reference to the other structures which must also have their place in, under or over the sidewalks, and the sufficiency of the plans and of the completed structure under both ordinances.

Books for City Councilman.

Will you kindly give me a list of books and other publications that will make up a good working library for a city councilman.

Is there any publication taking the place left vacant by Municipal Affairs of the Reform Club of New York?

Where can I obtain the proceedings of the National Municipal League, American Society of Municipal Improvements and others of the same class?

R. L. L., Camaguey, Cuba.

The following are excellent books for a city councilman, most of them upon the subject of municipal improvements, which is the one of most importance, and none of them strictly technical books, but they are correct technically and written with a view to their use by the non-technical city official:

Baker's "Municipal Engineering and Sanitation" ($1.25 net);

Whinery's "Municipal Public Works" ($1.50 net);

Fairlie's "Municipal Administration" ($3);

McCullough's "Municipal Public Works" (50 cents);

Zueblin's "American Municipal Progress" ($1.25 net);

Wilcox's "The American City ($1.25 net);

Mason's "Water Supply" ($5);

Taylor's "The Elements of Taxation" (25 cents);

Judson's "City Roads and Pavements" ($2 net);

McCullough's "Engineering Work in Towns and Small Cities" ($3);

Munro's "The Government of European Cities."

The best library for a city councilman is MUNICIPAL ENGINEERING, because its monthly numbers keep him abreast of the advances of the present day and its bound volumes keep in shape for his convenient reference the record of the best practice in municipal improvement and in planning and supervising the progress of the work.

System of Accounts for Small City.

I am an auditor in a borough of about 2,000 inhabitants and have been requested to work out a system of accounting with a view to improving on their present practice. I am anxious to acquaint myself with the most recent ideas on the subject and would be obliged to you if

you can refer me to some literature on the subject, outlining a system of accounting that would be adaptable to the requirements, with information as to forms, etc.

A. O. PEARCE, Pittsburg, Pa.

The subject of municipal accounting has been well worked out in committee reports and addresses before the American Civic Association and the National Municipal League and the annual reports of the latter organization since 1901 contain much that would be of value in fixing the principles upon which a system of accounts should be based. The report for 1902 gives the schedules adopted for uniform reports of the transactions of municipalities and examples of the application of these forms to the reports of several cities. While these forms of report are not forms of accounts they show the principles upon which the forms of accounts should be based and the results. These volumes can be obtained of Clinton Rogers Woodruff, the secretary of the National Municipal League, North American building, Philadelphia, Pa.

The most practical example of what should be done in establishing a system of accounts, especially for a small city, can be seen in the work of the department in the office of the Ohio Auditor of State at Columbus. That state instituted a supervision of the accounts of its municipalities some four or five years ago and the department of supervision has prepared full forms for all the various kinds of municipal offices in the state and for the managers of public service institutes. These forms are practical, in constant use, and are corrected and improved as needs develop. The auditor will doubtless give full information about them, and, while they may not be directly applicable to Pennsylvania conditions, they are a practical application of the principles developed in the committee of the National Municipal League and will be of great assistance in preparing forms of accounting for a particular city.

One of the members of the committee above referred to, John F. Mulhall, has prepared a book entitled "Quasi-Public Corporation Accounting and Management" ($5). It is confined to water, gas and electric light works, and steam heating plants, with some attention paid to telephones, electric railways, etc.

The subject of municipal accounting has been discussed frequently in MUNICIPAL ENGINEERING and forms for water works accounts and electric light plant accounts have been worked out. The water works system has been published in form for use and can be procured in books of any size desired. A number of articles on the subject will be found in MUNICIPAL ENGINEERING, vol. xii, pp. 85, 149, 218, 292, 353, vol. xiii, p. 69, etc. The forms for electric light plant accounts are given in vol. xviii, p. 237, vol. xix, pp. 67, 251, 326, 398.

Forms for reports from all municipal offices having charge of the construction and operation of public works and public service industries have been prepared by committees of the American Society of Municipal Improvements and are given in several of the reports of that organization, notably those for 1902 and 1903. These, again, are not forms of accounts, but indicate what items should be shown in the summaries of the accounts and thus the method of itemizing the accounts.

Concrete and Brick for Sewers.

Our city council is considering bids for the construction of a sewer system to cost $50,000 to $60,000, and is unable to decide as to which is the better, brick or concrete. We would like an expression of opinion from you on the subject.

W. L. B., ———, Ind.

Assuming equal experience and ability of the engineers designing and supervising the construction of concrete and brick sewers, the question is simply one of relative cost. Usually the concrete sewer of, say, 3 feet diameter or more will cost less than a brick sewer and will be chosen for that reason. This may be the case even with smaller sewers. There may be local reasons why the brick sewer would be cheaper in a certain city, such as low price of good sewer brick, high price of cement, scarcity and consequent high cost of concrete materials, nature of soil, quantity and depth of ground water, etc. It is quite common to receive bids for both brick and concrete and to choose the material to be used after the bids are opened, even in Indiana cities where there is sometimes question of the legality of receiving bids on alternative materials.

There have been some reports recently of the decomposition of concrete sewers laid in the alkali soils of the Northwest, and also of the concrete in the walls of septic tanks, but these reports need not throw doubt upon the value of concrete for general sewer work where the soil does not have large proportions of alkalies in it, for concrete has been used for sewers in cities from Milwaukee east to Brooklyn for twenty or thirty years, with no showing of deterioration from the action of the liquids flowing through them.

Two-Piece Blocks for Walls of Buildings.

A cement magazine says: "Some machines make a block of two pieces, one inside block and one face block. These have been universally condemned by building inspectors and architects as entirely unsafe and unfit for buildings of any description." I would thank you for your opinion.

E. L. R., Mattituck, N. Y.

The quotation given is not a statement of fact. It is not true that the two-piece block has been universally condemned. On the contrary, it has been accepted and used by many architects and builders, with the approval of building in-

spectors, in buildings of good design, both large and small, public and private. The view of one who would claim that he made truthfully such a statement as that quoted is so restricted that his opinion can have no value.

Information About Public Baths.

The City of Quebec is considering the advisability of erecting public baths; will you please inform me if I can find anything in MUNICIPAL ENGINEERING concerning the construction of public baths, method of construction, cost, etc. Is there any book treating on the subject?

W. D. BAILLAIRGE,
City Engineer, Quebec, Can.

The following articles upon public baths will be found in recent numbers of MUNICIPAL ENGINEERING:

"Public Baths," vol. xxxiv, p. 85.

"Public Baths in Rochester, N. Y.," vol. xxii, p. 210.

"The Brookline Baths," vol. xxiii, p. 236.

The Brickbuilder, an architectural journal in Boston, recently published a series of photographs and plans of public bath houses in various cities of the world.

Allsop's "Public Baths and Washhouses" ($2.50) may be the book desired.

Information on Street Cleaning and Garbage Collection and Disposal.

The city being desirous to establish a scavenging system, I would be much obliged if you would tell me where I could find articles treating on the subject in your valuable publication, of which I am an old subscriber. I would also be thankful if you would recommend the best book which I could purchase on the subject.

W. D. BAILLAIRGE,
City Engineer, Quebec, Can.

The term scavenging is something applied to both street cleaning and garbage collection and removal. The following list of articles therefore covers both lines. It is not complete, for almost every number of MUNICIPAL ENGINEERING contains something on one or both subjects, but it includes most of the recent leading articles:

"A Street Cleaning Automobile," vol. xxxiv, p. 266.

"Methods and Cost of Street Cleaning," a list of previous articles on the subject, vol. xxxiv, p. 299.

"Garbage Disposal and Street Cleaning," vol. xxxiii, p. 236.

"Cleaning Streets by Flushing," vol. xxxiii, p. 318.

"Street Cleaning Apparatus in Dresden, Germany," vol. xxxiii, p. 384.

"Refuse Destruction for the Borough of Richmond, New York City," vol. xxxii, p. 39.

"English, German and Swiss Destructor Plants," vol. xxxii, p. 371.

"Waste Paper Receptacles for Street Corners," vol. xxxii, p. 391.

"Westmount, Que., Garbage Destructor," vol. xxxi, p. 50.

"Purification of Slaughter-House Refuse at Zerbst, Germany," vol. xxxi, p. 86.

"Disposal of Dye and Wool Finishing Waste," vol. xxxi, p. 204.

"Garbage and Refuse Disposal in Pittsburg," vol. xxxi, p. 210; in Boston, p. 210.

"Garbage Disposal by Reduction Methods," vol. xxxi, p. 211.

"Odorless Excavators," vol. xxxi, p. 280.

"Street Cleaning and Disposal of Sweepings," vol. xxxi, p. 374.

"Street Cleaning Methods in Cleveland," vol. xxxi, p. 437.

"Disposal of Garbage in Small Towns," giving a list of previous articles on the subject, vol. xxxi, p. 454.

"Power from Garbage Destructor," giving a list of earlier articles on the subject, vol. xxx, p. 25.

"Garbage Incineration for St. Louis," vol. xxx, p. 28.

"Garbage Ordinance," governing accumulation and removal of garbage in Chicago, vol. xxx, p. 34.

"Garbage Collection and Disposal in St. Louis," vol. xx, p. 214.

"Street Cleaning in Baltimore," vol. xxx, p. 293.

"The Incineration of Municipal Waste," vol. xxix, p. 255.

"Cost of Garbage Collection and Disposal, a list of articles and books giving information on this subject, vol. xxix, p. 352.

"Portable Refuse Destructors," vol. xxix, p. 366.

"Economic Garbage Disposal," a list of articles on waste destruction and utilization, vol. xxix, p. 429.

"Systems of Garbage Collection and Disposal," vol. xxviii, p. 393.

"Street Cleaning Statistics," a list of articles giving cost in various cities by various methods, vol. xxviii, p. 448.

The books on street construction contain a little on street cleaning, such as Byrne's "Highway Construction" ($5) and Aitken's "Road Making and Maintenance."

Books for a Civil Engineer's Library.

I am a practicing engineer and wish to accumulate a library, but can only buy one book on a subject at one time. Will you please advise through your columns what should be my first, second and third purchase on the following subjects:

1. Civil Engineering (General Practice).
2. Streets, Roads and Pavements.
3. Sanitary and Storm Sewerage.
4. Water Works.
5. Inspection of Plumbing.

D., Mineral Wells, Tex.

The list of "Books for Engineers" which was given in various numbers of MUNICIPAL ENGINEERING beginning with April, 1907, and ending in January, 1908, gives brief notes concerning each book listed and should be of assistance in making a selection for an engineer's library. The list is based on one prepared by a committee of the Association for the Promotion of Engineering Education, with many

additions. From the list the following suggestions are drawn in an attempt to give a specific answer to the question:

1. Johnson's "Materials for Construction" ($6); Johnson's "Engineering Contracts and Specifications" ($3); Trautwine's "Civil Engineer's Pocketbook" ($5).

2. Baker's "Roads and Pavements" ($5); Byrne's "Highway Construction" ($5); Tillson's "Street Pavements and Paving Materials" ($4).

3. Folwell's "Sewerage" ($3); Staley and Pierson's "The Separate System of Sewerage" ($3); McCullough's "Engineering Work in Towns and Small Cities" ($3).

4. Turneaure and Russell's "Public Water Supplies" ($5); Folwell's "Water Supply Engineering" ($3); Hazen's "Filtration of Public Water Supplies" ($3).

5. Starbuck's "Modern Plumbing" ($4); Lawler's "Modern Plumbing, Steam and Hot Water Heating" ($5); Gerhard's "House Drainage and Sanitary Plumbing" (50 cents).

If our readers would make different selections, we hope to hear from them with the reasons for any changes they may make in the books of the above list or in their order.

Experience with Concrete Pavements.

We are contemplating the laying of some concrete pavement and I would like to get some information in regard to the same. Can you tell me what the experience of other towns has been in regard to this class of work?

Of course we have ideas of our own, but the experience of others may help us quite materially in drafting out specifications and making our plans.

What has been the experience of other cities in regard to the life of concrete pavement? Are they laying any at all, or as I have been informed, are they taking it up?

I have written to several places where they have laid concrete pavements, but up to date have received no reply.

GEO. W. ROBERTS,
City Engineer, South Omaha, Neb.

There have been several reports in MUNICIPAL ENGINEERING regarding experience with concrete street pavements and specifications for them have been given several times, showing the methods of construction used in various cities.

In the July number, vol. xxxv, p. 36, will be found a description of the methods of construction in use in Kottbus, Germany, and some statement of the satisfaction given after use for various periods up to ten years.

In vol. xxxiv, p. 168, will be found a number of answers to questions regarding methods of construction of concrete pavements with references to the previous articles on the subject. Abstracts of the various specifications are there given and references to other articles giving them in more detail.

One of the Bellefontaine, O., street pavements was constructed some sixteen or eighteen years ago under a rather insufficient set of specifications, but it is still in existence. In a recent interview with J. C. Wonders, formerly city engineer of Bellefontaine and now State Highway Engineer of Ohio, it was learned that there is no question of the durability of concrete for street paving. The trouble with these early pavements arose first from slipperiness, the surface having been troweled as for a sidewalk and the pavement having been laid in large blocks similar to sidewalk blocks. Mr. Wonders thinks the surface can be finished with a certain degree of roughness which will reduce the slipperiness but will not materially increase the wear of the surface under traffic. In the earlier pavements with the large blocks there was not sufficient allowance for expansion and this has given some trouble and made some repairs necessary. The surfaces of the large blocks were grooved with chisel and hammer to give better foothold for horses, but without much success, and some ruts have worn in the pavement along such grooves, which would probably not have appeared if the first finish of the pavement had included the grooves. It was thought that with the large blocks it would never be necessary to cut into the pavement, for the large blocks could be removed, as they are separated from each other by tar paper, and they could be replaced over the trench after it was filled. In practice, however, the blocks are not so removed and replaced but the cut is made into the pavement and the concrete is replaced entirely new. The size of blocks or whether there are any are not important questions, therefore.

The writer knows of no concrete pavements that have been taken up on account of their condition. Specifications for Bellefontaine are given in MUNICIPAL ENGINEERING vol. xvii, p. 384; for New Orleans in vol. xx, p. 341; for Grand Rapids in vol. xxiii, pp. 335 and 400; for Toronto in vol. xxvii, p. 350; for Richmond, Ind., in vol. xxviii, p. 386; for Le Mars, Iowa, in vol. xxxiii, p. 412; for Gary in vol. xxxiv, p. 329. An article on "The Evolution of Pavements," vol. xxxiv, p. 336, will also give some information on the subject. In vol. xxxiv, p. 357, will be found a list of cities having concrete pavements. To this list may be added Kewanee, Ill., and Denver, Colo.

The failures reported are for the same reasons as those given above for Bellefontaine and in New Orleans the separation of the top wearing surface from the foundation coat under expansion and vibration from street car tracks where the pavement was not properly laid and the top was not properly joined to the foundation. The traffic in the various cities varies from light to very heavy, both in number and weight of vehicles, and the only complaints of serious wear are in continuous longitudinal grooves, where ruts form as above described in Bellefontaine.

How to Test a Water Works Pumping Plant.

Can you give me the name of a book which would give general directions for making a test on a water works pumping plant? L. J. T., Greencastle, Ind.

Turneaure and Russell's "Water Supply Engineering" ($5) contains the necessary information. The program for a particular test depends somewhat upon local conditions and should be made by an engineer experienced in such work.

Comparative Strength of Brick and Hollow Concrete Block Walls.

We began the erection of all new fair grounds buildings out of cement stone blocks some three years ago and since that time have built an Exposition Building 200 by 375 feet, an Agricultural Building 84 by 375 feet, an Administration Building 30 by 160 feet, an Art Hall 125 feet square, a Club House 30 by 60 feet and the back wall of our grandstand 300 feet long. The architects, with a few exceptions, and the brick men as a whole, have fought us from start to finish, even so far as to make the assertion that no cement stone block made would hold up more than five years. An assertion has now been made by brick people that any three men can push down an 8-inch cement stone block wall. Of course I know this is all bosh and it strikes me that I have read somewhere in your journal of a comparative statement of a test that had been made on the strength of a brick wall 8 inches thick and a cement stone wall 8 inches thick, both as to their compressive and lateral resistance. If you have a report of such a test handy and will send me a copy of it it will materially aid me in the fight to continue the use of cement stone on the Fair Grounds. The formula out of which all of these blocks have been made is as follows: Blocks made face down, face composed of one part cement, three parts pure silicate granite screenings and a small measure of sharp clean sand, for the backing one part cement, four parts sharp clean gravel and sand. Each stone has a key counter sink in each end and when fitted together in a wall this counter sink is filled up with cement mortar. Now what I would like to know, compared with an 8-inch brick wall, which will stand the most downward pressure and side pressure.

STATE FAIR OF TEXAS, SYDNEY SMITH,
Secretary, Dallas, Tex.

This question is discussed quite fully in an article on "Building Regulations for Concrete Blocks" in MUNICIPAL ENGINEERING vol. xxxii, p. 165. While the exact comparison suggested in the question is not made, it is shown that the concrete block wall, if made of good blocks, is stronger than the ordinary brick wall of the same net area of cross section. If the brick wall is solid and the concrete block wall is hollow, the latter will be the thicker for the same net area of section and will be proportionately stronger to resist overturning. With the bond given by proper laying of blocks and the keying described in the question, there is no reason for a statement that the block wall will be less stable than a brick wall of the same thickness.

Engineering Fees for Street Paving.

I would thank you to inform me what is the usual charge for preparing plans and specifications for paving work that will cost from $100,000 up. Also the usual charge for engineering superintendence and inspection during the construction of the paving work costing from $100,000 up.

T. E. P., ———, Va.

There is at present no schedule of charges for engineering services. Some years ago MUNICIPAL ENGINEERING published the schedule adopted by the California Association of Engineers nearly twenty years ago. According to that schedule, for work costing from $100,000 to $200,000 the proper charge for preliminaries, plans and specifications, and details, three items together, is 1.9 per cent. Supervision and engineering superintendence is 2.4 per cent, making the total 4.3 per cent. It is evident that if the street grades are not established, street lines are difficult to find, and the work is badly scattered, the cost of the first item would be much more than if the work were simply to revise a grade and alignment already very nearly correct and all on one street. Some allowance may be made for such differences in conditions by increasing or decreasing the percentage as the local conditions may warrant. Supervision is also less expensive on a single street under a single business-like contractor than on several streets scattered and under different contractors who are slow in doing their work, thus increasing the number of inspectors required and the length of their employment. Here is another opportunity for adjustment of fee to suit the conditions.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Another Double Artesian Well.

In their investigation of the wells and underground waters of Florida, the geologists of the United States Geological Survey have noted many interesting things. Among these is a well at Welaka, on St. Johns river, from which two kinds of water are obtained.

This well is 309 feet deep. The length of the casing is 110 feet. The well was first drilled to 160 feet, and from this depth ordinary "sulphur" water was obtained. The drill was then carried to a depth of 309 feet, where it encountered a strong mineral water, having a disagreeable, salty taste. In order to use both kinds of water an inner tubing was run nearly to the bottom of the well. Both this and the outer casing were connected with pumps, so that ordinary water and mineral water can be pumped at the same time. A favorite joke played on visitors is to give them a drink of the weaker water in the first glass and to replace it with the brine in the second.

Not more than half a dozen wells of this kind are known in the country, but there is no reason why similar wells can not be obtained in regions where the waters in the upper strata differ from those lying deeper.

In these investigations of the waters of Florida the national and state surveys are co-operating, and much valuable information was gathered during last winter's work.

A Hydraulic Dredge for Pumping Sand and Gravel.

Several companies in Indianapolis which furnish sand and gravel for building and engineering constructions obtain their supplies from White river and Fall creek by means of small hydraulic dredges. Mr. H. C. Huffstetter, of the Brown River-Sand and Supply Company, furnishes the data from which this description of a plant is compiled.

The machinery of the plant consists of a 50-h.p. boiler, a 40-h.p. engine, a No. 8 centrifugal pump and a friction hoist, located on a flat-bottomed barge, and a set of screens, located on a tower on shore. The barge should be not less than 22 by 70 feet to balance and successfully operate the machinery.

A hood of 20 inches diameter is located on the end of the suction pipe, having legs or lugs which reach the bottom first and permit the in-draft of water from the sides sufficient to carry up the sand and gravel. Across this hood inside are five rods, spaced so as to prevent large boulders entering, such as would injure the pump or the suction and delivery pipes. These pipes are 8 inches in diameter, of cast iron, weighing about eight pounds per foot when new, although six pounds is heavy enough and is more easily handled. The vertical outside end of the suction pipe is of any desired length, say 20 feet, and is joined to a pipe of similar length extending to the barge. There a 6-foot length of rubber hose permits vertical and lateral movements, as may be desired. This suction pipe is supported by a line from the friction hoist, running on a projecting derrick, and the point of support is so located as to balance as nearly as may be the weight each side of it. The suction pipe on the dredge runs as directly to the pump as possible. The delivery pipe rises vertically three or four feet, then runs horizontally to the rear of the dredge, where another length of rubber hose permits motion of boat or of delivery end. The pipe beyond the flexible joint is likewise supported by a line from the hoist, and discharges the water, sand and gravel through a sixteenth or eighth bend aaginst the first screen. Chutes from the screens lead the various sizes to different piles, the fine sand being carried to a bed where it has an opportunity to settle out of the water, most of which goes with the sand, and the water overflows into a drain or directly into the river.

A plant of this size will pump from 500 to 600 cubic yards a day of gravel and sand in soft pumping, at the regular speed of 500 revolutions a minute. The principal points of wear are the bends, the rubber hose, which lasts about six months, the delivery pipe next to the pump, which lasts six to eight months, the shell of the pump, which must be replaced after pumping about 20,000 yards,

say every forty days, and the pistons, two of which wear out to one shell.

The ordinary centrifugal pump has its hub fastened on by bolts, which run through, where they are readily cut by the sand and must be renewed frequently. Mr. Huffstetter has developed a method of fastening the hub on by outside lugs which removes this difficulty.

A small service pump is used for various purposes, among others to keep sand out of the centrifugal pump bearings and to keep them cool, by means of a half-inch pipe connection inside the stuffing box, which washes the sand out as rapidly as it comes.

A new shell costs $90, the rubber hose costs $8 a foot. The cost of operation and maintenance of most of the machinery can be computed from the operation of like machinery in the same locality.

The plant will not pump compacted mud readily. If a layer of such material is found a hole is worked through it so that it will cave in, and it can then be pumped, coming through sometimes in masses like small boulders in size. A jet of water under pressure discharging about the hood, or some mechanical device for breaking up the mass, might help in case the proportion of such material is large and it is not readily handled.

Cost of Creosoted Wood Block Paving.

Bids were received at Grand Forks, N. D., on July 23 for about $160,000 worth of paving. City Engineer J. J. Smith supplies the following information regarding the work to be done, creosoted wood block having the preference:

The bid per superficial square yard of treated wood block pavement includes taking up old cedar block paving, repairs until contractor receives payment in full for the work, all transportation, labor and material necessary for the concrete foundation, sand cushion, treated wood block wearing surface, filler, top dressing, expansion joints, two-year guarantee, bonds, water, excavation, sub-soil drainage, tile drainage, gravel, raising street intersections, boulevards, backfilling, embankments, ramming, rolling, raising or lowering all castings to surface of paving or curb, earth approaches, changing old cedar block paving where new paving joins same so that the surface of both kinds of paving will be uniform, conforming all new paving to street hay scales, filling gas and sewer tunnels on De Mers avenue, gravel, wearing surface, expansion joints, repairing walks, curbs, paving or other works disturbed, all work as shown by plans, specifications, proposal and everything necessary to entirely complete paving in place except new catch basins, new sewer inlets, new headers, new curb, relaying curb, straightening curb, new sewer pipe and man holes. But the surface area occupied by all hay scales, the public watering fountain and watering fountain stone pavement relaid, and surface castings occupying part of paved roadway shall be measured and paid for as paved area only. All measurements to be horizontal.

16,000 lineal feet of 4-inch vitrified clay tile drainage in trench 1 foot wide by 18 inches deep below bottom of concrete.

Sub drainage across street every 50 feet. Trench 1 foot by 18 inches below concrete filled with gravel.

Seventy cubic yards of sand or gravel used to raise each street intersection.

Sand for intersection, 25 cents per cubic yard plus one mile haul.

Gravel, $1.55 per cubic yard f. o. b. cars Grand Forks.

Creosote blocks, 3½ inches deep with 20 pounds of creosote, approximate cost $1.715 per square yard f. o. b. cars Grand Forks.

Portland cement, approximately $1.70 per barrel f. o. b. cars Grand Forks.

Common labor, $2 per 10 hours.

Gravel for concrete to be screened.

P. McDonnell of Duluth, Minn., was apparently the lowest bidder. An area of 2500 square yards cost 50 cents a square yard more than the other 48,000 square yards. On the latter area Mr. McDonnell bid as follows per square yard:

For 3-inch blocks with 16 pounds of creosote	$2.72
For 3-inch blocks with 20 pounds of creosote	2.79
For 3½-inch blocks with 16 pounds of creosote	2.92
For 3½-inch blocks with 20 pounds of creosote	3.02

These are compared with the following prices for other paving materials per square yard:

Cedar on concrete	$2.05
Asphalt B, 1½ inches thick	2.20
Tar macadam	2.25
Asphalt B, 2 inches thick	2.30
Asphalt A, 1½ inches thick	2.40
Blome granitoid	2.45
Asphalt A, 2 inches thick	2.50
Brick	2.75
Bitulithic	2.82

Calcium Chloride as a Dust Preventive.

The value of calcium chloride as a dust preventive was tested on the portion of the macadam driveway in the Agricultural Department grounds in Washington, D. C., which connects Twelfth and Fourteenth streets, and is reported upon by Logan Waller Page, Director of the Office of Public Roads.

The roadway is built of trap rock, held in position by a soft limestone binder. The screenings of this binder pulverized rapidly under traffic, forming a light dust which passing vehicles continually raised into the air. It was then carried away by the wind. In this way the road was becoming stripped of its binding material.

In preparation for the treatment all dust and dirt was scraped from the sur-

face of the roadway. A solution was prepared by mixing 300 pounds of commercial calcium chloride (granular, containing 75 per cent calcium chloride and 25 per cent moisture) with 300 gallons of water in an ordinary street sprinkler, care being taken to agitate the liquid thoroughly before applying it to insure a uniform solution. It was then applied from one sprinkling head, and the sprinkler passed slowly back and forth over the road to facilitate the complete absorption of the solution. Each application consisted of 600 gallons over an area of 1,582 square yards, or 0.38 gallon per square yard.

The first application was made July 13, 1907, followed by a similar one July 15, to increase the efficacy of the treatment. The effect of the first two treatments was marked. No auxiliary sprinkling was necessary for some time, the light rains falling at intervals supplying all the moisture required. The untreated portions of the driveway lying parallel to Twelfth and Fourteenth streets were sprinkled daily and vehicles raised a perceptible dust, although the traffic over these wings was much less than that on the treated portions.

During this time the appearance of the roadway varied perceptibly in color according to the moisture of the road surface, ranging from a light gray when dry to a peculiar grayish brown when moist. The brown shades were deepest over the portions traversed by the wheels of vehicles. The texture of the road surface was completely changed after the application of the calcium chloride. Before treatment, raveling was excessive in spots and the whole surface seemed loosely knit together. After the application on July 15 this condition changed and the road surface became smooth, compact and resilient.

The third treatment was given August 3, as certain points exposed to the most severe wear were showing signs of raveling. The phenomena following this treatment were not unlike those attending the first set of applications and repeated themselves as later applications were made, though no further treatments were given until the condition of the roadway seemed to demand it. Such auxiliary sprinkling as was necessary consisted in the application of about 0.2 gallon of water per square yard at a time.

The calcium chloride was donated by a manufacturing chemical company of Baltimore, Md., and is charged at the rate of $16 per ton, f. o. b. cars at Baltimore. A freight charge of 13 cents per hundredweight is added to place the material on the ground.

The specific gravity of these solutions ranged from 1.053 to 1.060. Some variation was unavoidable, as the calcium chloride in some of the barrels had absorbed a large amount of moisture from the atmosphere. In such cases the actual percentage of the chemical to 300 pounds was less than where little or no moisture had been absorbed.

At the time of the last application several hundred pounds of the salt remained unused. This was divided as nearly as possible into two parts, to be applied to the two wings of the driveway lying parallel to Twelfth and Fourteenth streets. The east wing received a treatment of 0.28 gallon per square yard of a solution the specific gravity of which was 1.145 and the west wing a similar application of a solution having a specific gravity of 1.121. No further sprinkling was found necessary for the remainder of the season upon these branches of the main driveway.

Cost of Applying Calcium Chloride.

600 pounds calcium chloride, at $18.60 per ton	$5.58
3 men for 1½ hours, at 15 cents per hour	.675
1-horse sprinkling wagon for 1½ hours, at 35 cents per hour	.525
Total cost of 1,582 square yards	6.78
Cost per square yard at this rate	.0043
Total cost of five applications	33.90
Cost per square yard of five applications	.0235

A Testing Machine of 600,000 Pounds Capacity.

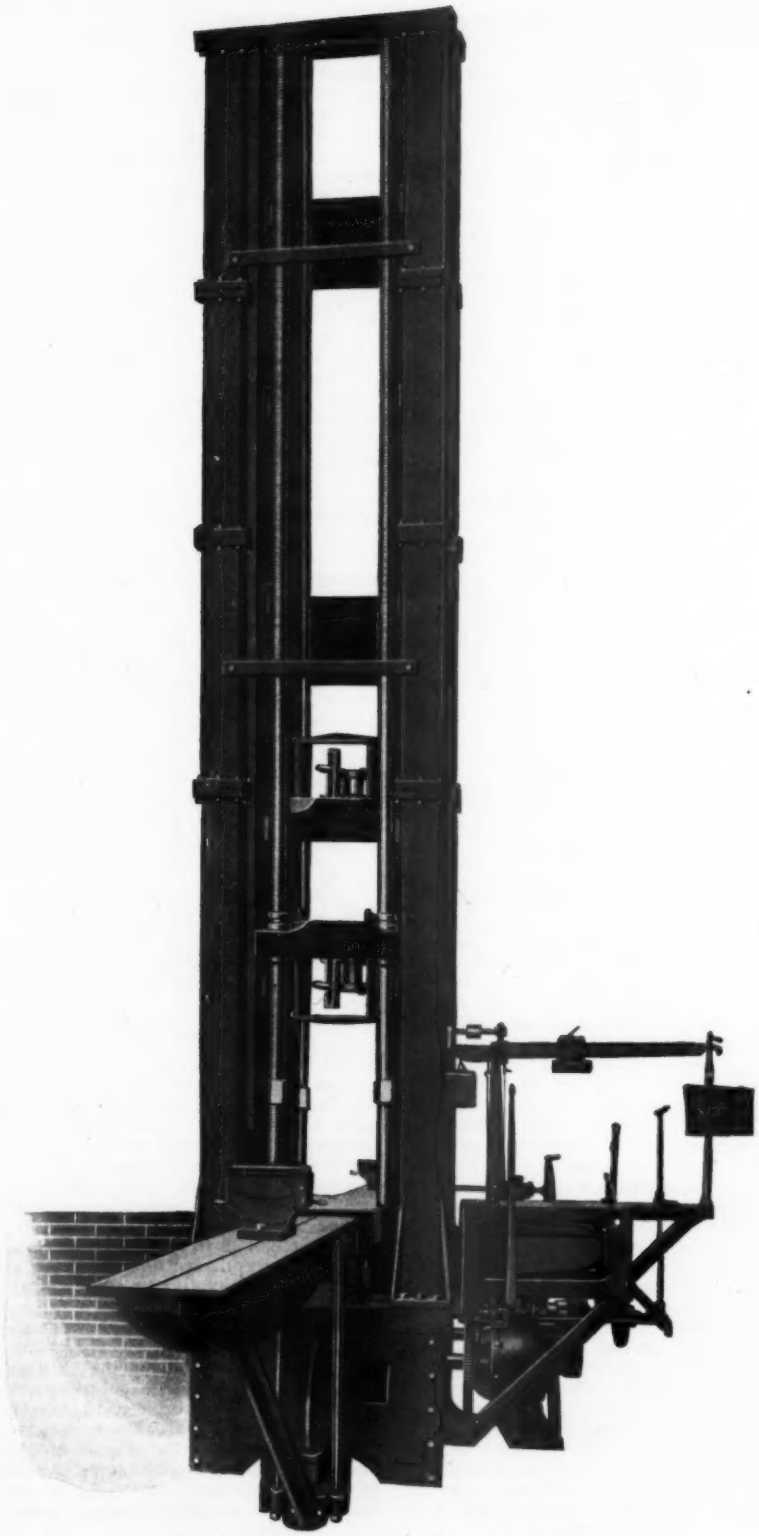
Editor of MUNICIPAL ENGINEERING:

Sir—Testing today has assumed proportions far greater than in the past. Methods of construction have changed largely since the introduction of reinforced concrete. Large beams and colums are being used in building construction which cannot be tested owing to the lack of large testing machines. Within the past few years the demand for testing full-size members has greatly increased. This increase has led to the building of large structural materials testing machines, the largest of which has recently been installed at the Structural Materials Testing Laboratory of the U. S. Geological Survey at St. Louis. The accompanying cut shows the genèral design.

The testing machine is of the "Olsen" type, built by Tinius Olsen & Co., of Philadelphia, Pa., with a capacity of 600,000 pounds, capable of testing a column 30 feet long, a tension member 24 feet long with 25 per cent elongation and a beam 25 feet between centers.

In designing this machine special care and precautions were taken to provide for strength, durability, ease of manipulation and speed changes, guides for traveling crossheads as well as device for absorbing recoil after rupture of specimen. The general mechanism of the machine may be divided into two general parts, the straining system and the weighing system.

The straining system consists of four main screws which are drawn down by the rotation of four straining nut gears placed below the base cover. The screws are held from rotating by keys at two places in base frame. This method of gearing



TESTING MACHINE OF 600,000 POUNDS CAPACITY.

insures a straight, even pull on the crosshead attached to the upper portion of the screws and also provides a surface support for same, which is essential for all compression tests, as for instance column tests. By placing the straining nuts below base cover all bending and twisting strains are eliminated and ample space is provided for long straining nuts, which on this machine sum up to 78 inches in length, thus insuring a great wearing capacity. The four main gears are driven by a four to one variable speed motor through a series of spur and bevel gears to obtain almost any speed from that of 10 inches a minute, used in setting upper head, to 0.025 inch per minute or the slowest speed used while making compression tests, or while taking micrometer readings for determination of the moduli of various materials.

The weighing system consists of three main levers acting as one lever between the base cover and weighing table, to which are connected the extensions for the beam tests. The pressure is transmitted from the main lever through an intermediate lever to the weighing beam, which in the case of the machine used by the Structural Materials Testing Laboratory, is completely automatic and self-recording.

To test long columns and tension members, the straining screws are spliced and straining crosshead connected to upper screws by means of spiral and spur gearing so it is readily raised or lowered by operating a clutch lever as shown below scale beam. To test long tension members the movable crosshead is used to raise or lower the upper crosshead to any one of five positions in which it may be held in the tension columns. For a long column testing special precaution must be taken to prevent side thrust on straining crosshead as might arise owing to the buckling of a column while being tested. The four-screw principle of gearing prevents this action to a certain extent and in this machine on account of the long columns to be tested a set of four guide columns were erected in such a manner as to act as one column in resisting a side thrust of 20,000 pounds at the extreme top in any direction.

To protect the knife edges of the lever system from the jar consequent to the rupture of a specimen under a high load, two recoil cylinders were placed directly under main frame of machine, so that the recoil of the lever system is gradually transmitted to the entire frame work and dissipated, thus protecting knife edges of the levers against the effect of such recoil. In addition to these recoil cylinders the customary check rods and rubber recoil washers are placed on the machine.

To calibrate this machine a special set of calibrating levers were constructed so that 100,000 pounds could be placed on machine to make the poises on scale beam the correct weight and the machine was tested and found to be accurate to the maximum capacity of 600,000 pounds by taking readings of the elongation of a bar of steel for equal increments of load applied within the elastic limit of the steel.

A machine of same capacity and somewhat similar dimensions was installed for the University of Pennsylvania and in accepting the machine independent tests were made of the machine, similar to those made at St. Louis, as to accurate sensitiveness, strength, recoil, resistance as to side thrust using a screw column, long beam test for the maximum capacity on the weighing table extension, the tests in each case showing the excellent qualities of the machine for all kinds of structural tests as may come within its scope and capacity.

A third machine similar to the University of Pennsylvania machine will shortly be installed in the new Engineering Building of the Rensselaer Polytechnic Institute at Troy, N. Y., together with a compression testing machine of 1,200,000 pounds capacity, for use on large concrete blocks.

The increasing use of concrete and reinforced concrete in building construction has caused the demand for still larger machines than those mentioned of 600,000 pounds and 1,200,000 capacity and today Tinius Olsen & Co. are working on a long column testing machine of 10,000,000 pounds capacity which, when completed, will be the largest machine of the kind in the world.

THORSTON Y. OLSEN, Philadelphia, Pa.

How to Lay Steel-Bound Curb.

Editor MUNICIPAL ENGINEERING:

Sir—Following are practical instructions for laying concrete curb with steel protection on corner and steel reinforcement:

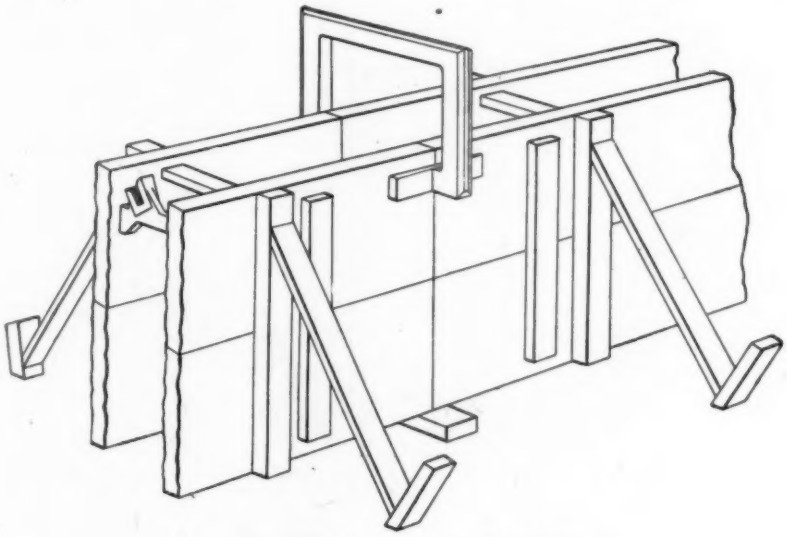
First—Excavate the trench for the curb, being careful not to dig deeper than you desire the bottom of the curb, which should rest on thoroughly solid ground. The bottom of the trench should be wider than the curb by three inches on each side, to allow of room to set and remove the frames. In cold climates where the ground is of a wet clayey nature which will hold water, it is sometimes desirable to put in a drainage foundation; in that case, a few inches of gravel or cinder is worse than nothing, for it only offers a chance for the water to accumulate beneath the curb, where it may freeze and lift it. If drainage is desirable, however, the curb trench should be dug about two feet below the bottom of the curb and a 3-inch porous tile should be laid its whole length, and should connect at the lowest points of the grade with the sewer or cesspool. Above the tile should be placed about 18 inches of cobblestone, brickbats, or any very coarse material, on top of which should be placed coarse gravel up

to the bottom of curb, but not more than 6 inches of gravel should be used. On this foundation set the curb.

Second—When the trench is prepared, then the frames should be set. See cut No. 1.

To set the frames, you require planks, stakes, outside braces, inside braces, wedges and iron brackets.

Third—The plank should be (for 20-inch curb) 18 inches wide by 2 inches thick by 20 feet long, dressed on one side and both edges. They are best when made of two 9-inch plank held together by four or five cleats, nailed on with eight-penny wire nails, so they can be easily removed to reverse the plank when the edges are worn. By this means a plank can be used ten or fifteen times with careful handling. Care should be taken



FRAME FOR LAYING CONCRETE CURB.

that they do not warp, and this can best be prevented by never allowing them to lie exposed to the weather, but carefully piled up when not in actual use. When they are wet they should be protected from the sun, particularly the face of them. This can always be done by handling them in pairs and keeping faces together. In moving them on large jobs a two-wheeled truck, similar to a painter's ladder truck, will be found very useful.

Fourth—The most desirable stakes are made from maple or ash wood; they should be 36 inches by 2 inches by 2 inches. It is economy to have them made by the hundred, and saw sharpened on four sides, with a 6-inch taper to a ¼-inch point. A badly pointed stake will soon be spoiled. A sharp hatchet should always be at hand to sharpen any stake that may become blunted, as a blunt stake should never be used; for driving, a wood maul is best. This care will double the life of a stake.

Fifth—Outside braces may be of any kind of cheap rough lumber, and a convenient size is 2 inches by 3 inches by 18 inches. These are used by placing one end against the ground and the other against the stakes or frame at a 45-degree angle, to steady the frame, keeping it true to the line when set.

Sixth—Inside braces for six-inch curb should be made of ordinary spruce or pine batten strips 2 inches by 1 inch, carefully mill sawed into 6-inch lengths, to be used between the frames to accurately space them. They should be used at frequent intervals to keep the frames rigid, so they will not shift after setting; as the concrete is put in place, the man who does the ramming can remove them. They should never be left in the curb.

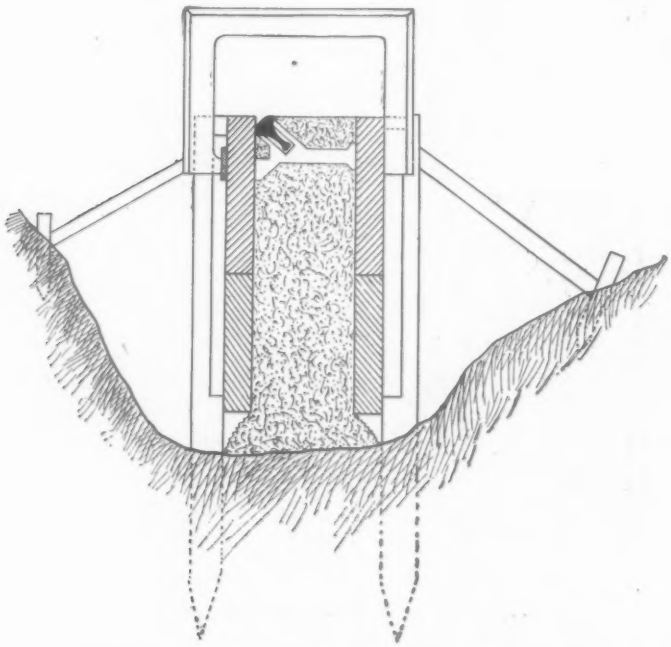
Seventh—Wedges should be made of maple; they should be about 12 inches long, and should taper from ¼ inch to about 1½ inches. They can best be made by taking a maple board 1½ or 2 inches thick and sawing it into strips about 1¾ inches wide, then cut to 12-inch lengths, then saw diagonally, lengthwise, to give above dimensions.

Eighth—Iron brackets are castings representing three sides of a square, with arms of varying length. The brackets are placed on top of the frames, with the arms extending downward several inches on either side; thus, with a 6-inch brace on the inside of the frame and a wedged bracket outside, you can obtain a rigid frame in which to place the concrete. This is very important, and the frames

should always be tested to see if they are rigid and true to line and grade before any concrete is put in place, or the work will not be true when finished.

Ninth—The first step in setting the frames, when you have all the materials ready, is to set a block of stone, brick or wood in the trench, 18 inches below the grade of the curb, to set your plank on (these may be left under the curb). You should set these blocks every 20 feet, so one block will do to sustain the ends of two frames. With these blocks carefully set, your planks will then be just to grade, which is the first and most important question; then drive two stakes exactly to line outside of the plank; this gives you grade and line; then put on the iron brackets every 4 or 5 feet apart, with the 6-inch wood braces between the planks, which complete the frame. Then drive more stakes both sides of the frame and set as many 18-inch outside braces as necessary to make the frame solid, first being sure that you have the exact line and grade. The inner plank should be three-sixteenths inch higher than the outside plank to give proper grade to the top of the curb.

Tenth—It is important that the surveyor's stakes should be set out (on the street side) 18 inches from the line of the curb, so you will not disturb them in doing your work. Always insist on their being well driven, so you can depend upon them during the work, and even after the work is finished; if a question arises as to line or grade, your proof is there. This saves much trouble, for the surveyors sometimes make mistakes, and this is the only way you can avoid the responsibility. After you have your trench dug, you can then set some temporary stakes in the trench, 18 inches from the surveyor's stakes, which will give you your exact line, and on which you can mark the grade after finding it with a spirit level from the grade mark on surveyor's stake. Run your lines from your own stakes, never touching the surveyor's stakes; thus if your stakes get loose you always have the originals to depend on.



CROSS SECTION OF CURB, AND FORM FOR LAYING.

Eleventh—After the frames are properly set, put in the concrete in layers of not more than 4 or 5 inches, and ram each layer well. Carry this work up layer by layer as fast as possible, so the bottom will have no time to set until after you have the top layer rammed, otherwise the jarring of the frame will spoil the lower part of the concrete. You should gauge the length of each layer by the size of the batch of concrete, so each batch will fill the frames to about 2 inches of the top. When there is enough filled to receive the "corner bar," lay the bar on top of the frame, and with a properly shaped tool cut the concrete not less than 6 inches deep, at the exact point where the joint comes at the end of the bar.

Into this cut sprinkle a little sand, and ram the concrete again, which will solidify the concrete and close the joint, except for the small sand cushion; use care not to get sand on top of the concrete, or it will cause a separation where you do not want it.

Twelfth—Setting the Corner Bar. First remove the 6-inch wood braces along the top of the frames between the iron brackets, and in place of them put the iron frogs, which are designed to hold the bar. A 10-foot bar should have one 6-inch iron frog in the middle and one at each end. Set them as near level as possible, with the top lip about level with the frame, then slide the bar under the brackets (this you can do by depressing one of the brackets either to the right or left of the position the bar is to occupy), and set the bar in the iron frogs, driving it down with a wooden maul to its place, which can be ascertained by a straightedge held across the frames, as it should be on a line with the inner and outer grade of the curb. See cut No. 2.

Before setting the bar, with a trowel put some fine top mixture along the top of the concrete, extending up the front plank to the top, and tapered down about 45 degrees to the top of the concrete; this gives the cushion in which to set the bar. You should always be sure there is some surplus. If there is any doubt about it, lift the bar enough to put a little more under it. The surplus will squeeze out from beneath the bar, insuring a solid and perfect bed, otherwise the bar might work loose after the curb is set.

Next fill in behind the bar and on top of the concrete with a little more concrete to about one inch of the frame, and tamp carefully, on which place the top mixture or finish coat; work it well into place, particularly around the bar, and finish soon as possible. Care should be used to make a good joint at the end of each bar. Cut with pointing trowel through to sand joint in concrete.

Thirteenth—The frames should not be removed until the next day, when you should at once float the front of the curb down about 6 inches below the bar with a mixture of fine sand one part, cement one part, mixed with about 8 per cent. by measure of carbon to give proper color. In any event, it is best not to remove the frames until you can face up the work. If the work has set more than twelve hours it should be wet before putting on the facing. Do not put on any more facing than necessary to fill the holes in the concrete, or it may crack off. It is better done with a float than with a trowel, and should be mixed very wet, so if the concrete is smooth it can be put on with a brush, then floated.

Fourteenth—Concrete should always be mixed on a platform, unless you have a clean, smooth pavement to work on, like asphalt or brick. The most convenient platform is made from 1½ inch boards, cleated to two by threes, laid flat, each section being 5 feet by 16 feet. Two of these make a good platform and can easily be moved by four men. The boards should be dressed on one side, tongued and grooved, of hard pine. This will be found economy in the end. A good concrete mixture can be made of one part of Portland cement, three parts clean, sharp sand, and five parts of clean stone (trap rock preferred), sized from ⅛ inch to 1 inch, never larger. It is sometimes necessary to use more cement.

A wet mortar should first be made of the cement and sand on one end of the platform, then add the proper amount of stone, after it is well saturated with water. Care should be taken not to get the concrete too wet. When it is too wet it will show moisture after being rammed in the frames. This should never be allowed. If by carelessness it should happen, a little dry concrete should be added to take up the surplus water.

Top or finish coat should be mixed in a box; a convenient size is 6 feet by 4 feet on the bottom, and about 10 inches deep, and with both ends set at an angle of about 35 degrees outward flare. This makes it more convenient to use the hoe in mixing, also in filling the pails, which can be set on the ground under the flaring end and filled with the hoe quicker than any other way.

A good top mixture can be made with one part granite, one-sixteenth inch to one-fourth inch in size, free from dust, one part clean, sharp sand and one part high-grade Portland cement. To each barrel of cement add four pounds of carbon (lamp black); this will give the most desirable blue color.

H. A. M., New York City.

Foreign Trade in Cement.

The imports of cement into this country during the year ending June 30 were almost exactly 1,500,000 barrels, which was about half of the importation in the preceding year and about 20 per cent. more than in the year ending June, 1906. Nearly 40 per cent. of the importation last year came from Germany and about 95 per cent. came from England, Belgium and Germany.

The exports of cement were 945,421 barrels, which is 236,000 barrels more than the next preceding year and 136,000 more than the second preceding year. About 19,000 barrels of the foreign cement were re-exported. This leaves the balance of imports greater than exports about 536,000 barrels, between 1 and 2 per cent. of the total consumption of cement in this country. Our export trade does not yet amount to 2 per cent. of the home consumption.

MUNICIPAL AND TECHNICAL LITERATURE

Cleaning Chicago—Washington Water Supply—New Publications

Cost of Keeping Chicago Clean.

The annual reports of the city of Chicago show that the city is increasing its efforts to keep clean in some directions. The work done in street and alley cleaning in 1907 was very nearly double that done in 1906. The mileage of streets and alleys cleaned in 1907 was 48,744.33, and as there are 4,251.24 miles of streets and alleys, the average number of times a street was cleaned was 11. Much of the cleaning is restricted to paved streets, of which there are 1,451.17 miles. The number of loads of dirt removed was 216,408, or about 4 loads per mile of street cleaned. The expenditure was $738,650.44, which averages $15.15 per mile, or $3.41 per load of dirt removed. It was necessary to clear of weeds 344.83 miles of street. Inlets to catchbasins were opened and cleaned to the number of 1,184,165 under the appropriation for street cleaning. The sewer department reports 24,974 catchbasins cleaned, at a cost of $3.86 each, which seems to be additional to the work reported by the street department.

There are 1,726.8 miles of sewers, of which 564.6 miles were cleaned during the year at an average cost per mile of $108.79. The total cost of cleaning sewers and catchbasins by the sewer department was $204,329.37, which is $118 a mile of sewer. The total expenditures for sewer maintenance were $405,383.97, which is nearly $235 a mile.

Snow removal cost the city $50,000, or $1.42 per load of snow removed. This does not include work done at private cost.

Since January 1, 1907, refuse has been collected by the city, separated into garbage and ashes and rubbish, and taken to the reduction plant for cremation. Of the pure garbage 45,577 loads, or 162,266 cubic yards, were removed at a cost of $338,755.34, which is $7.21 a load, or $2.09 a cubic yard. Of ashes and rubbish there were removed 245,930 loads, or 1,228,763 cubic yards, at a cost of $684,327.48, which is $2.78 a load, or 60 cents a cubic yard. This makes the total cost of garbage, ashes and rubbish removel $1,023,082.82. These figures are compared with $726,899.53 the year before, or $777,373.55, when the cost of maintaining the city dumps is included, the garbage being collected promiscuously and hauled to dumps in various parts of the city in 1906. There were 292,474 loads, or 1,463,960 cubic yards, hauled in 1906, making the cost of removing the refuse $2.48 a load, or 50 cents a cubic yard.

The total number of free baths taken at the thirteen public baths was 709,826 in 1907, as compared with 825,315 in 1906. About 50,000 of the difference seems to be due to the closing for repairs of one of the houses for the last six months of the year.

The expenditures of the department of health were $562,165.69. Over 18,700 nuisances were abated, 6,246,000 pounds of food stuffs were condemned, 57,501 sanitary inspections of buildings were made, 64,348 chemical analyses and 11,104 bacteriological analyses.

The smoke inspectors received 680 complaints, made 16,847 observations, visited and sent notices of violations of ordinance to 6,777 places, and brought 496 suits. This was but little more than one-third as many suits as were brought the preceding year.

Water Filtration and Meters in Washington.

In his annual report, submitted to General Marshall, chief of engineers, Major Spencer Cosby, engineer officer in charge of the water supply system of the District of Columbia, recommends the universal use of meters as a preventive of waste of water, and the use of a coagulant in the preliminary treatment of Potomac water. The average consumption of water for twenty-four hours during the fiscal year 1907 was 66,900,000 and for the fiscal year 1908, 64,910,000 gallons. Major Cosby says that in accordance with the act of Congress approved May 26, 1908, appropriating the sum of $10,000 for preliminary investigations and surveys for increasing the water supply, an investigation will be begun at once. As reported annually for several years, the present system cannot be safely depended upon to supply a greater quantity of water to the city than it is actually furnishing at present. The investigation to be undertaken is only a preliminary step, and the additional works necessary to secure an increased supply will require several years to construct, even after they are authorized by Congress. It is absolutely essential that measures for the prevention of waste be continued in order that the in-

creased demand due to an increased population may be fully compensated for by a reduction in waste.

It is believed that universal metering, if adopted, should reduce the per capita consumption to less than 120 gallons per day, the experience of other cities having shown that that is ample for all household, commercial and public purposes. It is recommended that the Federal Government set an example in that respect and that all Federal buildings and institutions be metered. According to an estimate made by the Commissioners of the District of Columbia during the year 1905 the quantity of water supplied daily to these institutions was about 9,000,000 gallons. At the prevailing meter rates, the value of that quantity of water is about $131,400 per year.

Considerable attention is devoted to the filtration plant and the preliminary treatment of Potomac water. An estimate of $90,000 is submitted, for remodeling the Georgetown reservoir and constructing works to provide for the preliminary treatment of Potomac water by means of a coagulant, in addition to the unexpended balance of the appropriation for a slow sand filtration plant. He says:

The filtration plant has been in continuous operation throughout the year, and the entire water supply of the city has been filtered. The bacteria have been reduced from an average of 1,252 per cubic centimeter in the McMillan Park reservoir to an average of 55 in the filtered water reservoir. The average turbidity has been similarly reduced from 31 to 2 parts per million. The actual number of bacteria in the city water varied from 900 to 4 per cubic centimeter, while the number in the river water ran from 80,000 to 16. The actual average reduction by months varied between 99.7 and 93 per cent. The total quantity of water pumped to the filters during the year was 23,758.24 million gallons, or an average of 64.91 million gallons per day. While the quality of the city filtered water was excellent for the greater part of the year, there were several periods when the number of bacteria exceeded what is considered by experts to be the proper standard for a filtered water supply. The filtered water was unsatisfactory with respect to turbidity for a considerable percentage of the time. This confirms the experience of the two previous fiscal years, and also the judgment of the three experts as expressed in their report, dated February 18, 1901.

It is not believed, however, that the slight turbidity in the water now furnished to consumers in the city of Washington has any direct injurious effect; there is no traceable relation between the high bacteria counts and the death rate from typhoid or other water-borne diseases. The cost per million gallons filtered was $3.13. A year of elaborate experimentation has shown conclusively that the water can be materially improved by the use of preliminary coagulation during periods of high turbidity and high bacterial counts. It has also been shown that the methods of preliminary filtration used at Philadelphia and elsewhere will not give satisfactory results when applied to Potomac water.

Experience since the filtration plant was first put into operation has shown that Washington is being supplied with a good and wholesome water. It has also shown that there is still room for improvement in certain directions. The experiments conducted in the past year and a half have shown how such improvement can be effected and they have demonstrated that Washington can be at all times supplied with a water that is unexceptional, both in quality and appearance. In order that the city of Washington may at all times be supplied with such water it is recommended that works for preliminary coagulation be constructed and estimates for that improvement are submitted.

New Publications.

Waermetechnische Grundlagen von Drehoefen und Kohlenstaubfeuerung. By Frederich C. W. Timm, C. E. 91 pp. paper. 4 marks. Tonindustrie Zeitung, Berlin, Germany.

This paper is one presented to the Association of German Portland Cement Manufacturers in discussion of the future of the rotary kiln for burning cement, and gives the technical principles of combustion in the kiln with pulverized coal as fuel. The results of practical tests are given with all the data of materials, fuel, temperatures, distribution of temperatures in the kiln, best temperature for calcination, etc. It shows the effect of length of kiln and of insulation, length of time of materials in kiln, heating the air before entry. It describes the rational kiln for the wet process, the use of the waste gases for drying and heating purposes, etc. The details of construction of a kiln are described with gas and with powdered coal used as fuels. The conclusion states the points which must be observed and the tests which must be made in order to determine the method of operating any kiln in order to get the best and most economical results of which it is capable.

Concrete Construction Methods and Cost. By Halbert P. Gillette and Charles S. Hill. 620 pp. Cloth, $5 net. The Myron C. Clark Publishing Co., New York and Chicago.

The authors of this book have made a very full collection of data from many sources, with various degrees of reliability concerning the cost of concrete work of nearly every class. The chapters discuss the methods and cost of selecting and

preparing materials for concrete, of making and placing concrete by hand and by machine, of depositing concrete and mortar under water, of making and using rubble and asphaltic concrete, of laying concrete in freezing weather, of finishing concrete surfaces, of form construction and of constructing in concrete and reinforced concrete piles, piers, fortifications, locks, dams, breakwaters, bridge piers and abutments, retaining walls, pavement foundations, sidewalks, curb and gutter, lining of tunnels and subways, arches and girder bridges, culverts, buildings, monolithic and of separately molded members, aqueducts, sewers, reservoirs, tanks, and ornamental work. There is a chapter containing data on many miscellaneous operations in concrete, one on methods and cost of waterproofing concrete and concrete structures, and one on the theory and practice of proportioning concrete.

The present authors are the first to enter the field of publication of cost data and both of them have had some years of experience in collecting and preparing information of this sort for publication. They are entitled to the gratitude of engineers for their most valuable work in this field. At the same time, the user of the book must be cautioned not to accept the data given as directly applicable in his case. There has been an effort, which is most commendable, to give the available details regarding each piece of work, but these details are most difficult to procure and are often impossible to find. Something has been done toward supplying the lacks in this respect by analyzing the costs given, and where this has not been done it is quite necesary for the reader to check up carefully by his own experience. Mainly, no doubt, on account of the haste in preparing the material for publication, these analyses are not always carefully made, and the writer cannot always agree with the principle on which they are made. It goes without saying that many important details will be found lacking, but this is not the fault of the authors, but the misfortune of the profession.

Engineers and contractors using concrete will find the book the most valuable in practical suggestions and cost data of any that has appeared, and with heed to the warning about making the application to any particular case, will find it as reliable as a book could readily be made at this stage of advancement in the use of concrete and under the necessary conditions of haste in collection and preparation of data for the book.

Principles of Reinforced Concrete Construction. By F. E. Turneaure and E. R. Maurer. 317 pp. Cloth, $3. John Wiley & Sons, New York.

This is the first of the numerous recent books on reinforced concrete which has systematically presented the mechanics of reinforced concrete design, and put the results in simple form for closely approximate calculation with the least amount of labor. Like the cook books, one needs some knowledge of methods of manipulation to get the full value of the work, but great attention to details of mathematical and mechanical principles would detract from the convenience of use of the book and would confuse by the very mass of material necessary to cover that part of the field, the cultivation of which is properly left to books on mathematics and mechanics and omitted from a book which applies the results of these elementary studies to the design of structures in reinforced concrete.

The first part of the book gives the theory of the subject and reports of results of experiments with their direct application to the theories as stated. One chapter gives a short historical sketch and a list of the principal classes of structures in which reinforced concrete has been used. Another discusses the elementary properties of concrete and its ingredients, steel, and the combination of steel and concrete, giving the results of reliable experiments on compressive strength of concrete, tensile and shearing strength, modulus of elasticity, adhesion, extensibility, etc. The general theory of beams and columns in plain and reinforced concrete is developed in the third chapter, with many diagrams and formulae for use in the development and in the design and examination of beams. This chapter is notable for the brevity and at the same time the clearness of its treatment and applicability to all the standard forms of beam and column. The fourth chapter collects and illustrates the results of the tests which have been made on reinforced beams and columns and fully discusses and explains the results and the reasons for differences and discrepancies. Various kinds of material used for reinforcement in tension and compression parts of beams and in the web are described and the results of tests are given, thus giving data for assuming the constants in the formulae. Tests of plain and reinforced concrete columns are also given in full. The fifth chapter takes these results and works out values for the working stresses in concrete and in steel for beams and columns of various designs, and the sixth chapter collects the formulas, diagrams and tables conveniently for use. Rectangular and T-beams under various suppositions as to variations of stress, beams reinforced for compression, flexure and direct stresses, shear and bond stresses, stresses in columns and in circular plates are the headings of the paragraphs, and each set of formulas has its sets of tables and diagrams.

The application of the principles developed to construction is made in the later chapters. The seventh treats of concrete floors, of various forms and dimensions of slabs, methods of reniforcement and of support, beams and girders, columns, and the various methods of combination of these elements of a building, footings,

walls and partitions. The eighth chapter is devoted to the arch and works out a simple method of analysis, based on the elastic theory, applicable to arches of variable moment of inertia loaded in any manner. The method is mainly algebraic, with some graphical aids for use if desired. If one is familiar enough with arch design to assume dimensions closely approximating the proper dimensions, the method gives a very easy and quick solution, but is simple in any event and much shorter than strictly accurate methods, although giving results which are practically as good. Retaining walls of various designs, dams, beam bridges, trestles, pipe and box culverts, conduits and pipe lines are treated in the last two chapters.

Among the many interesting details considered is the economic value of steel reinforcing in columns. The cost of the reinforcement and the increase in strength are compared in various designs, usually showing increase in expense to be greater than increase in strength.

Designers in reinforced concrete cannot afford to work without this book. It presupposes knowledge of the principles of mechanics and mathematics and of the manipulation of concrete, and some practice in elementary design, but it can be read and used with profit by all earnest students of the subject. For the designer it is a saver of time and for the engineer who is not constantly designing reinforced concrete structures it is the most satisfactory book that has yet been published.

The only adverse criticism the writer has to offer is upon the proportion of typographical errors in the text. It is not known whether the same proportion obtains in the tables, but if so the figures in them must be carefully watched.

Commercial Organic Analysis; a treatise on the properties, modes of assaying and proximate analytical examination of the various organic chemicals and products employed in the arts, manufactures, medicine, etc., with concise methods for the detection and determination of their impurities, adulterations and products of decomposition. Third edition, rewritten and revised. Volume II, part III, Acid Derivatives of Phenols, Aromatic Acids, Resins and Essential Oils. By Alfred H. Allen, F. I. C., F. C. S., the revision by the author and A. R. Tankard, F. C. S. Cloth, 547 pp., $5. P. Blakiston's Son & Co., Philadelphia, Pa.

This is one volume in an encyclopedia of commercial organic analysis consisting of eight volumes, and covering the field of chemical analysis of organic substances of commercial value. The above description, taken from the title page, tells what the book contains and gives a general idea of the method of treatment, and it is sufficient to say that the collection of information is well classified and arranged for convenient reference, and is apparently complete so far as present knowledge extends.

A Treatise on Highway Construction. Designed as a text-book and work of reference for all who may be engaged in the location, construction or maintenance of roads, streets and pavements. By Austin T. Byrne, C. E. 1,024 pp. Cloth, $5. John Wiley & Sons, New York City.

Full reviews of this book appeared in MUNICIPAL ENGINEERING some years ago, when the fourth edition appeared. The present edition has again been revised and about 120 pages of new matter have been added, bringing substantially all parts of the book down to date. A list of the additions will show the principal lines in which advance has been made in the improvement in roads and streets in the past six or eight years.

The historical sketch calls attention to the state and national aid to highway improvement which has been begun and carried out during that period. The present objection to guaranty bonds is expressed. There is a full discussion of the agencies causing destruction of road materials, and the new methods of testing materials to determine their resistance thereto. The qualities which stone must have to resist these agencies most successfully and tests therefor are added. Additions are made to the specifications and tests for asphaltic cement and concerning foreign matters therein. Similar additions are made regarding wood for paving blocks. Medina sandstone specifications for stone block paving are inserted. Wood block pavement specifications are enriched by matter regarding foundations, blocks and their chemical treatment to minimize decay and expansion, laying and filling joints, and the creo-resinate and kreodone processes are described. The new fillers and guaranty clauses are added to the brick pavement specifications, also an additional example of city specifictaions. Considerable new matter is added to the chapter on broken stone pavements concerning thickness of layer, sizes of stones, binders of various kinds, steam rolling, and wear, and there is much new material on tar macadam, steel trackways, asphalt macadam, bitulithic, and several other less prominent pavements of similar materials. In the engineering section the width of wheelway on curves, geologic considerations in road location, oiling of roads, road repair and reasons for deterioration, snow removal, street flushing and sprinkling, fuller specifications for cement, specifications for steel highway bridges and street sprinkling trucks, new asphalt pavement machinery, new street cleaning machinery, motor vehicles for municipal service, a full description of most of the many methods now under test for suppressing the dust nuisance, effects of heat on pavements, the new problems of maintenance and the attempts at their solution are the principal additions.

Being the latest book, this is the nearest up to date on the whole subject, and re-

tains its standing as the book giving the best treatment of the subjects of highway construction and maintenance.

General Specifications for Concrete Work as Applied to Building Construction. By Wilbur J. Watson, M. Am. Soc. C. E. 46 pp. Paper, 50 cents. W. J. Watson, Cleveland, O.

The author here states in regular specification form his conclusions regarding the proper methods of constructing buildings in concrete so far as materials and workmanship are concerned. The general headings of the sections of the specifications are, massive concrete, reinforced concrete, assumptions for computing reinforced concrete, reinforced concrete details, unit stresses, loads, reinforced steel building construction, reinforced concrete unit construction, concrete blocks and cast stone, final tests, anchorages, openings, etc., forms, surface finish, waterproofing, expansion joints, concrete piles, concrete floors and wearing surfaces, freezing weather, proportioning, mixing, and placing, materials, special structures, contractor's plans, general conditions and requirements, contract, architect's or engineer's drawings. While all will not agree with some of the details of the specifications, since there is still room for much difference of opinion, these specifications seem to be safe and in convenient form, and they can be modified by the individual architect or engineer to suit his own ideas. They should have considerable effect in bringing about greater uniformity in the specifications for concrete in building.

The booklet also contains the standard specifications for cement of the American Society for Testing materials and a brief statement of method and formulae for proportioning reinforced concrete beams.

ORGANIZATIONS AND INDIVIDUALS

National Municipal League—Technical Meetings—Civil Service—Personal Notes

National Municipal League Convention.

The National Municipal League will meet in Pittsburg, Pa., November 17, 18, 19 and 20, in conjunction with the American Civic Association.

Its membership now numbers 1,442, but this does not include the various local organizations affiliated with the league, numbering 120, having a combined membership of 115,000.

Attorney-General Charles J. Bonaparte, of President Roosevelt's Cabinet, is the president of the National Municipal League. Its other officers are: First vice-president, Charles Richardson, of Philadelphia; second vice-president, Thomas N. Strong, of Portland, Ore.; third vice-president, Judge Henry L. McClune, of Kansas City; fourth vice-president, Walter L. Fisher, traction advisor to Mayor Busse, of Chicago; fifth vice-president, ex-Mayor James Phinney Baxter, of Portland, Me.; secretary, Clinton Rogers Woodruff, of Philadelphia; treasurer, George Burnham, Jr., also of Philadelphia, formerly of the Baldwin Locomotive Works.

J. Horace McFarland, of Harrisburg, Pa., is the president of the American Civic Association. The other officers are: First vice-president and secretary, Clinton Rogers Woodruff, of Philadelphia; vice-presidents, L. E. Holden, of Cleveland, of the *Plain Dealer;* Fielding A. Stilson, of Los Angeles; Robert Watchorn, of New York, Commissioner of Immigration; George B. Leighton, of New Hampshire; treasurer, William B. Howland, of New York, of the *Outlook;* chairman of advisory committee, Robert C. Ogden, of New York.

Mayor George W. Guthrie, of Pittsburg, is chairman of the local committee on arrangements, with Mr. Oliver McClintock as vice-president.

Technical Meetings.

The annual convention of the New England Water Works Association will be held at Atlantic City, N. J., September 23, 24 and 25. Willard Kent, secy., 715 Tremont Temple, Boston, Mass.

The annual convention of the League of American Municipalities will be held at Omaha, Neb., September 30, October 1 and 2. John MacVicar, secy., Des Moines, Ia.

The annual convention of the Illuminating Engineering Society will be held at Philadelphia, Pa., October 6 and 7. Van Rensselaer Lansingh, secy., Engineering Societies' Building, 33 W. 39th st., New York City.

The annual convention of the American

Street and Interurban Railway Association will be held at Atlantic City, N. J., October 12, 13, 14, 15 and 16. B. V. Swenson, secy., 29 W. 39th st., New York City.

The seventh annual convention of the Vermont Electrical Association will be held at Bennington, Vt., September 16 and 17.

The annual meeting of the Michigan Gas Association will be held at Kalamazoo, Mich., September 23, 24 and 25. Alonzo P. Ewing, secy., Gas Office Bldg., Detroit, Mich.

The next convention of the National Association of Railway Commissioners will be held at Washington, D. C., October 6. W. H. Connolly, secy., Washington.

An International Roads Congress will be held in Paris October 11 and several days following this date.

The Wisconsin Municipal League will meet at Oconomowoc, September 2 to 4. J. R. Currens, president, Two Rivers; W. G. Kirchoffer, secy., Madison.

The Institution of Municipal Engineers is a new organization in England which is now procuring charter members from this branch of the civil engineering profession, and claims two hundred already. B. Wyand is the secretary, 10 Eagle Place, Piccadilly, London, W.

The American Society of Municipal Improvements will meet at Atlantic City, N. J., October 20 to 23. No intimation of the program has been received, but it will undoubtedly be good.

The users of concrete in England have formed "The Concrete Institute" and have established headquarters in Waterloo Place, Pall Mall, London.

The sixteenth convention of the National Irrigation Congress will be held at Albuquerque, New Mexico, Sept. 29 to Oct. 3 inclusive.

Sewer Discharge Under Buffalo Harbor Must Stop.

The city of Buffalo, N. Y., has been formally notified by Luke Wright, Secretary of War, that it must close its trunk sewer which empties into Niagara river. The city is given until July 1, 1910, to act.

In the notice from Secretary Wright it is stated that when the city got permission to construct the sewer under the harbor, the state reserved the right to revoke the notice and order the sewer closed. When the state deeded the harbor lands under water to the government it conveyed also the right to close the sewer. The order to close it is issued as a consequence of the government's work on the Black Rock ship canal. The canal is to be 23 feet deep. The top of the sewer is 20 feet below the original level of the harbor and about 17 feet below its actual level. If the government dredges even 20 feet below actual level it would rip the sewer to pieces.

The trunk sewer outlet drains nearly the entire city, all of the lateral sewers emptying into it at one place or another. An outlet built any other way than under the harbor will prove a costly and difficult engineering task.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

Sept. 16: Timber testing engineer in Philippine forestry service at $1,800 a year; writer of specifications and computer, office of Quartermaster-General, War Department, Washington, D. C., at $1,200 a year.

Sept. 16, 17: Civil engineer in Philippine service at $1,400 a year; examiner of surveys in General Land Office service at $4 a day, traveling expenses and $3 a day subsistence, with promotions to $5 and $6.

Sept. 23, 24: Surveyor in Philippine service at $1,400 a year; irrigation engineer on irrigation investigations, office of Experiment Stations, Department of Agriculture, at $1,500 to $2,000 a year.

Personal Notes.

Julian W. Kendrick has resigned as city engineer, at Birmingham, Ala.

W. N. McEniry has resigned as city engineer at Bessemer, Ala.

S. H. Hinckley has resigned as chief engineer of water works at Mobile, Ala.

F. P. Burr has resigned as superintendent of the water board, at Middletown, Conn.

A. H. Julian has been appointed superintendent of sewers at San Diego, Cal., to succeed Joseph McInnis.

C. G. Vaughn, M. Am. Soc. C. E., and consulting engineer, died at his home in Natchez, Miss., August 4, aged 51 years.

John B. Shinn, assistant engineer in the sewer department, at Washington, D. C., has been promoted to assistant surveyor.

Hon. Walter G. Fitzgerald has been elected mayor, R. E. Wood, P. W. Parmelee, A. W. Martin, W. B. Stuart and J. W. Thayer councilmen, and E. F. Rogers city clerk, at Gilroy, Cal.

W. N. Morrill, Assoc. M. Am. Soc. C. E., has resigned as constructing engineer of the Sewer Commission, at Louisville, Ky., to engage in other business.

Melvin C. Hazen has been appointed surveyor of the District of Columbia, at Washington, D. C., to fill the vacancy caused by the promotion of William P. Richards to the office of assessor. Mr. Hazen has for three years served as assistant surveyor of the District.

Theodore A. Leisen has resigned as engineer of the board of water commissioners, at Wilmington, Del., to accept a similar position in Louisville, Ky., succeeding Charles Hermany, who recently died. Mr. Leisen will be succeeded at Wilmington by John A. Kienle, who has been chief assistant for some time.

F. G. Clapp, formerly with the U. S. Geological Survey, and A. W. Bee have opened offices at 610 Fitzsimmons building, Pittsburg, Pa. Their practice will include geology and the allied branches of engineering, having to do with coal, oil and gas properties, wells, ground waters and public water supplies, and minerals, with the surveying, mapping and drafting accompanying investigations on these lines.

MACHINERY AND TRADE

Collapsible Forms for Making Concrete Road Culverts.

The problem of culvert building involves two items, chiefly quality and low cost. In any new country, where timber is plentiful, of course small timber bridges serve where the gullies are too deep for ordinary hauling, but wherever scientific road making is practiced, the easiest gradients, covering the longest stretches possible, are laid out by engineers. Hence many culverts are required, and culvert building has become an important question with all road authorities. The almost limitless utility of concrete construction makes it easy to understand the popularity of the collapsible culvert form, which is offered for sale by the Miracle Pressed Stone Co., 19 Wilder street, Minneapolis, Minn. As the name implies, it is a set of two galvanized iron forms — two 6 or 10-foot lengths making one set — that are laid in the ditch, and the Portland cement concrete is tamped about them. In a few hours the cement has set and the culvert forms are removed for use at another place.

These culvert forms are designed in sizes from 1 to 4 feet in diameter, capable of meeting any ordinary requirement. As the concrete is in one solid piece from end to end, its strength and permanence is assured.

A special offer to road authorities proposing to demonstrate the practicability of the process at any point which may be selected by the supervisors has led to the sale of many of these outfits to county and township boards. Where sand is available near the culvert, and lumber must be hauled as from the railroad point, it has been demonstrated that concrete culverts can be made cheaper than lumber, clay pipe or corrugated iron.

Cost of Asphalt Street Repair Work.

The following estimates of cost of repairs of asphalt streets are furnished by the Guelich Portable Asphalt Plant Co., 302 West Jackson Boulevard, Chicago, Ill., and are made for the Guelich plant B1:

The B1 plant contains a mixture of a little over 3,000 pounds in the drum, operating, cooking and discharging the drum every fifteen or twenty minutes, giving an output of 3,000 pounds every twenty minutes, or 18 cubic yards of repair material, 54 square yards per hour, or 540 square yards per ten-hour day, against 250 square yards of other plants' ten-hour day work, an increase in yardage per day of 190 per cent.

The operating expenses of the plant include:

One engineer	$3.00
One fireman	2.00
One plantman	2.00
One dumper	2.00
One sandwheeler	2.00
One sandshoveler	2.00
One elevatorman	2.00
500 pounds of coal	1.00
Seven men and fuel cost	$16,00

Seven plantmen produce 540 square yards, the cost of which is $16.00, or a cost per square yard of not quite 3 cents for plant labor and fuel, or a saving of 8.35 cents per square yard over other plants requiring 13 men and double the fuel, amounting to $29 a day total cost.

The above showing does not take the cost of material nor cost of spreading and laying into account, assuming that they may be the same where new material is being used. However, where the old surface is used, which, it is claimed, can only be done by the Guelich plant, the difference in cost is very marked. The old material is dumped into the mixing drum and there cooked and then spread upon the street the same as new material, being made as good as new through the cooking process, according to the claims of the makers. A small percentage of flux should be added to this material, ascertained by an analysis made of the old stuff in advance of the paving operation. The saving of using the old material found in the streets is, first, the haul to a convenient dump, which cost may approximate 5 cents per square yard; second, the cost of new material less about 2 per cent of flux, say 10 cents per square yard. Figuring the total cost of new material, sand, carbonate and asphaltic cement at 40 cents per square yard, there will then remain a saving of 35 cents per square yard in favor of the use of old stuff.

Mixing Concrete for Street Pavement Foundations.

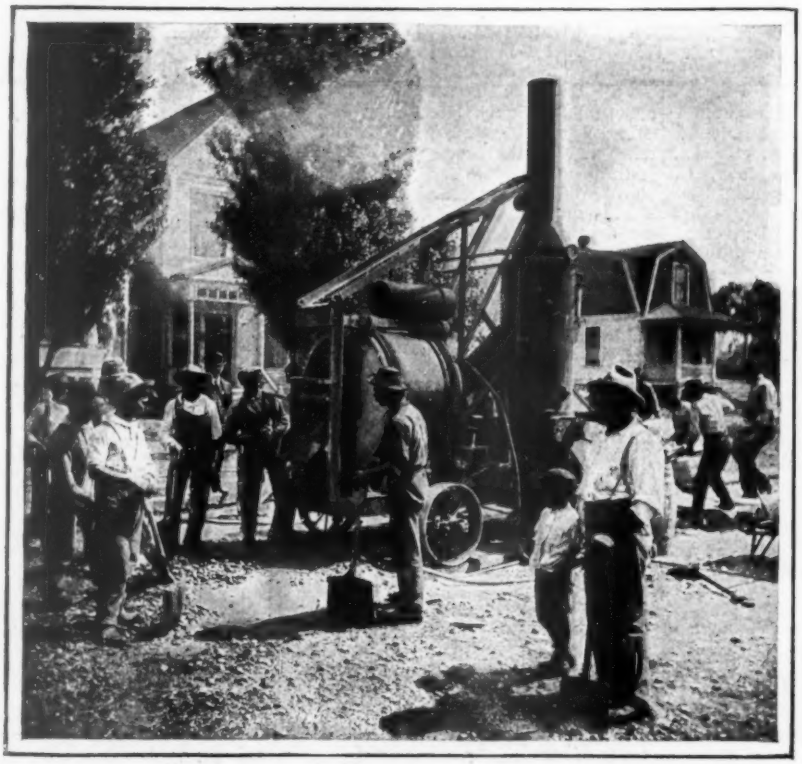
Pavement foundations are now of concrete almost without exception, and it is of vital importance that the concrete should be well mixed. This work often receives the least attention. In many cities the concrete is mixed by hand with serious results in sunken spots that are due to poorly mixed concrete.

The accompanying illustration shows a

batch mixer built by the Koehring Machine Co., of Milwaukee, Wis., at work on a street in Chicago. This mixer is known for its rapid and thorough mixing, is built entirely of steel and iron, has automatic loading bucket and water measuring tank. Its construction permits its use on the narrowest streets. The loading bucket, being only 12 inches above the street level, does not require any platform or runway planks. The machine is also self-propelling for moving it along the line of work.

The Standard Paving Co., of Chicago, who did the work illustrated in the cut, report that they laid 1,170 square yards 6 inches deep in 9 hours with a gang of 26 men and the Koehring mixer.

The Koehring Machine Co., who have their general office at 501 Germania Bldg., Milwaukee, Wis., build a general line of mixers and anybody interested in concrete mixers should write for their catalogue.



KOEHRING CONCRETE MIXER ON A CHICAGO STREET

Bristol, Tenn., Must Purchase Private Water Rights.

A decision has been handed down by Chancellor H. H. Haynes, in the case of Mattox et al. vs. the City of Bristol, Tenn., in which he holds that the city can not deprive the plaintiffs of their riparian rights, near the water supply at Preston Springs, without compensation or condemnation proceedings. The city recently constructed a new water system at a cost of about $300,000, and suit was brought to restrain the city from diverting water from Preston Springs, to the alleged damage of persons depending upon the same for their water. As the decision is against the city, it may now become necessary to purchase water rights from a number of persons.

Trade Publications.

The Chicago Pneumatic Tool Co. issue a catalog of Franklin air compressors in advance sheets from their catalog No. 26.

The Advance Concrete Mixer Co., Jackson, Mich., issue an illustrated circular concerning their concrete mixers.

The Rockwell Furnace Co., New York, issue two catalogs of portable heaters and melting furnaces.

Bulletin No. 25 of the Jeffrey Mfg. Co., Columbus, O., published in July, is devoted to apparatus for handling coal and ores, and contains advance pages from forthcoming catalogs 20-A and 28.

The Barrett Mfg. Co. issue a new booklet on "Tarvia the Dust Layer," showing where the hot and cold processes have been used, and the results, in handsome illustrations and full text.

The Chicago improved cube concrete mixer is described in a new booklet issued by the Municipal Engineering and Contracting Co., Chicago, Ill.

One of the interesting illustrations in the August bulletin of the Universal Portland Cement Co. is the view of the result of an explosion and fire in a stone crushing plant, which destroyed the wooden framework of the building and wrecked practically all the machinery, but left the concrete in foundations and walls intact.

Economy unit frames for reinforcing concrete, ready to place in the forms, are shown in a circular of the Expanded Metal and Corrugated Bar Co., of St. Louis, Mo.

The August bulletin of the Expanded Metal and Corrugated Bar Co., St. Louis, Mo., is devoted to standard designs for bridges and culverts for highway traffic of the flat slab and girder type.

"The Universal Unit System" is the subject of a pamphlet on steel reinforcement in concrete construction, coming from 132 Nassau st., New York.

The Northwestern Expanded Metal Co., Chicago, issues a booklet of hints on specifications for reinforced concrete structures.

James B. Nelson, former city engineer at Indianapolis, Ind., recently died suddenly of gastritis, following an operation for appendicitis.

Trade Notes.

ASPHALT.

Tacoma, Wash.—The establishment of a municipal asphalt plant is contemplated.

BRICK.

Caney, Kas.—The American Vitrified Brick Co. has been organized and will build a plant here. The officers of the company are: President and general manager, O. A. Kentner, Coffeyville, Kas.; vice president, G. W. Cannelly, Caney; treasurer, John B. Paul, Mound City; secretary, E. N. Gause, Mound City.

Council, Idaho.—A deposit of asphaltum has been discovered about 10 mis. from here. Charles Whitley discovered a 5-ft. vein and will develop it.

BRICK.

Crawfordsville, Ind.—The establishment of a paving brick plant at Jacksonville, Ill., is contemplated by J. G. Poston, of this city.

CEMENT.

Los Angeles, Cal.—A. Moore, of this city, and others have organized a company and will erect a cement plant on the shore of Lake Pend d'Oreille, north of Spokane, Wash.

Chelsea, Mich.—The Millen Portland Cement Co. has completed its organization, with officers as follows: President, H. C. Millen; vice president, Bernard Selling; secretary, Blair Kincaid, Jr.; treasurer, Z. C. Eldred; directors, H. C. Millen, Bernard Selling, Blair Kincaid, Jr., Z. C. Eldred and G. W. Coe.

Great Falls, Mont.—Special.—The Montana Wall Plaster Co. has been incorporated to manufacture the various products of gypsum. The company's headquarters will be in this city and its mills at Monarch, near its gypsum deposits.

Mapleton, Kas.—The Guthrie Mountain Portland Cement Co., against which bankruptcy proceedings were filed, has discharged its indebtedness and the company will be reorganized and resume operations again.

Spokane, Wash.—The Acme Portland Cement Co. has been organized here, and a plant will be located 42 mis. northeast of this city on a tract of about 1,500 acres of mineral land recently acquired.

Victorville, Cal.—The Victorville Portland Cement Co. has located a deposit of cement 11 mis. from here. The officers of the company are: President, F. H. D. Banks; secretary, F. H. Merrill; director, J. S. Meacham; chemist, Prof. W. S. Truebiood.

Mason City, Ia.—The Lehigh Cement Co. will probably locate a cement mill here.

New York City.—The Knickerbocker Portland Cement Co. has been incorporated to manufacture Portland cement, by D. Baker, of Yonkers, N. Y., Thomas F. Barrett, 37 Wall st., New York City, and others.

Rockland, Me.—The New England Portland Cement Co. has been organized to manufacture and deal in Portland cement, with officers as follows: President, Alfred S. Black, of Rockland; treasurer, E. B. McAllister, of Rockland.

The Cement Securities Company, of Denver, Col., have appointed F. L. Smidth & Co., 41 Cortlandt st., New York, their consulting engineers. The Securities Company control Portland cement plants operating at Portland, Col., and Devil's Slide, Utah, and under construction at Three Forks, Mont., and El Paso, Tex.

Spokane, Wash.—The Acme Cement Co. has been organized here a large plant will be established. Aman Moore, president of the Cement Engineering Co., of Los Angeles, is interested and associated with him are A. L. Wright, of this city; Carroll A. Low, of Pullman, Wash.; Chas. M. Fassett, of this city; Robert Rennie, city, and others.

Security, Md.—The plant of the Maryland Portland Cement Co. was set in operation July 25. The officers of the company are: President, De Courcy W. Thom; vice-president, Loring A. Cower; sales manager, Harry B. Warner; consulting engineer, Major F. H. Lewis.

CONCRETE BLOCKS.

Omaha, Neb.—D. M. Click has sold his artificial stone plant to Joseph Saunders, of Seneca, S. D. Ed P. Landers will continue as manager.

Grand Forks, B. C.—B. Lequime, of this city, contemplates the manufacture of cement building blocks.

Fargo, N. D.—The Fargo Cornice and Cement Co. has been incorporated by M. E. Rusk, George Rusk and H. G. Given.

Mayville, N. D.—The Electrical Cement Post Co. has been organized here by W. H. Robinson, W. C. Poulsson, of Mayville; Gunder O. Berge, Hillsboro, N. D.

Worthington, Minn.—The Worthington Concrete and Tile Co. has commenced the manufacture of cement blocks, and will begin the manufacture of drain tile about Sept. 1.

Spokane, Wash.—The American Concrete and Engineering Co. has been incorporated by J. C. Adams, G. S. Adams and R. L. Battan.

Erie, Pa.—The Erie Concrete Brick and Block Co. has been organized, with officers as follows: President, Alfred Gunnison; vice president, Charles Wilson; secretary

and treasurer, Adam Karch; general manager, Holger Rommerdale; superintendent of works, F. R. Botsford.

Boston, Mass.—The Concrete Power Brick Co. has been incorporated by Frederick Allen, William G. Burns and others.

New Haven, Conn.—The Gale Field Concrete Co. has been organized at Orange, with officers as follows: President, W. G. Carleton; vice president, George H. Simmonds; secretary, C. H. Bird; treasurer and manager, Roling A. Baldwin. The company's plant is located on Derby ave., near the Maltby Lake. Concrete building block, sand brick, etc., will be manufactured.

Richmond, Va.—Jones & Chowning have begun the manufacture of concrete building blocks for building and paving purposes.

Nebraska City, Neb.—The Wilson Reinforced Cement Co. has established a plant here.

New York City.—The Ferro Concrete Contracting Co. has been incorporated here by Thaddeus Faber, James J. Sullivan and David H. Solotaroff, 35 Nassau st., New York City.

Brown City, Mich.—A concrete building and construction company has been organized here, with Jacob S. Witmer as president, Martain Taylor as vice president, and David Graybiel as secretary and treasurer.

Nashville, Tenn.—J. H. Peter has organized a company here to do a general stone and concrete construction business and manufacture artificial stone. Associated with Mr. Peter are J. B. Jurbee, C. H. Behmer, Henry Alstedt and Edward P. Wetstein.

Enid, Okla.—W. P. Demonst is establishing a plant here for the manufacture of molds and forms for concrete work.

Monon, Ind.—The Monon Cement Tile Co. has been incorporated by John S. Sandy, Harry A. Bond and Edward E. Sluss.

Hinton, O.—The Greenbrier Concrete and Construction Co. has been incorporated by George O. Queensbury, J. L. Crush, Howard C. Hinton, Edgar Crush, A. T. Visland and R. F. Dunlap, all of Hinton.

PROPOSED PURCHASE OF MACHINERY.

Antigo, Wis.—The purchasing committee of the city council has been directed to ascertain the cost of a steam road roller. Fred Hayssen, mayor.

Ogden, Utah.—The Modern Concrete Brick & Tile Co. has been incorporated by Percel Atchley, Edwin T. Wooley, Fred Masa and others.

PROPOSED PURCHASED OF MACHINERY.

Imperial, Neb.—Special. A. Nee desires the names of firms making forms or moulds for making cement tanks.

Dobbs Ferry, N. Y.—Special. Frank A. Condon desires to purchase electric hoisting motor and drum, buckets, blocks and cables.

PROPOSED PURCHASE OF MATERIALS.

Dobbs Ferry, N. Y.—Special. Frank A. Condon is in the market for Portland cement, sand and broken stone.

GARBAGE DISPOSAL—STREET CLEANING—SPRINKLING.

Sacramento, Cal.—The construction of a new garbage plant has been recommended by Mayor White.

Pasadena, Cal.—The city council has approved an ordinance providing for the construction of a garbage crematory. Herman Dyer, cy. clk.

Rankin, Pa.—The contract for constructing a garbage furnace has been awarded to the Decarie Mfg. Co., of Minneapolis.

MISCELLANEOUS.

Great Falls, Mont.—Special.—The Board of Commerce is collecting data on the traffic possibilities for an electric railway up the Sun river valley, through the Ft. Shaw reservation, which is now open to settlement, and through the large irrigated tracts to the northwest of this city. This road would be one hundred miles long.

A new machine shop and foundry is under construction for the Goldschmidt Thermit Company, of 90 West st., New York City, for the rapid execution of repairs to electric motor cases, truck frames, cast steel gear wheels, crank shafts, and, in fact, any wrought iron and steel sections not exceeding 2,000 pounds in weight.

Patents on Concrete Blocks, Bricks and Molds.

(Continued.)

857,474. Mold for making solid concrete silos. Wm. H. Lunberg, Plymouth, Wis.

857,524. Mold for fireproof construction. Wm. S. Hindman, Edgeworth and Paul H. Anthony, Ben Avon, Pa.

857,581, 857,582, 857,583, 857,584. Method, apparatus and core for molding hollow objects from cement (ducts). Jas. M. Boyle, New York City.

857,624. Brick molding machine. Thos. C. Holt, Minneapolis, Minn.

857,737. Machine for molding cement bricks, blocks and the like. Herbert J. Hurd, Berlin, Ont., Can.

857,977. Cement block machine. Thos. D. and Clarence W. P. Brock, Waterford, Ont., Can.

857,995. Block machine. Henry G. Grisier, Stryker, O.

858,192. Manufacture of blocks. Ignatius Lucas, Passaic, N. J.

858,232. Gravity tamping and molding machine for plastics. Alfred J. Taylor and Jos. H. McClure, Waterville, O.

858,480. Hollow concrete wall mold. Alton I. Sprague, Rutherford, N. J.

858,502. Mold for artificial stone. Orville, Dougherty, Jas. W. and Adam Armstrong, Three Rivers, Mich.

858,605. Cement block machine. Fred W. Johnson, Edmore, Mich.

858,933. Building block for concrete construction. Edward J. White, New York, N. Y.

858,939. Hollow stone structure. Andrew Angeloro, New York, N. Y.

859,119. Building block. Chas. R. Schmidt, Baltimore, Md.

859,120. Art of forming (and filling) molds. Chas. R. Schmidt, Baltimore, Md.

859,471. Building structure (concrete lintel). Arthur F. Walker, Atlanta, Ga.

859,704. Mold. Geo. W. Stevens, Boston, Mass.

859,764. Building block. Lester W. Hagerman, Orchard, Neb.

859,947. Reinforced concrete building block. Solomon M. Kemp, Baltimore, Md.

860,012. Building block. Frederick Christian, Wichita, Kans.

861,144. Apparatus for molding blocks. Wesley M. Scott, Columbus, O.

861,462. Cement block machine. Fred W. Hawk, Knoxville, Ill.

861,964. Building block. Wm. P. Gamber and Wm. A. Pinckny, Stanton, Mich.

862,043. Cement block molding machine. Wm. M. Akers, Decatur, Ia.

862,367. Method of making molded blocks or bricks. Frank Zagelmeyer, Bay City, Mich.

862,440. Method of manufacturing concrete blocks and slabs. Oscar Bradford, Chicago, Ill.

862,521. Knock-down adjustable con-

crete block machine. Jacob E. Street, San Fernando, Cal.

862,887. Building block. Jas. H. Denmead, Westpoint, Va.

862,925. Tile-faced building block. Wm. P. Meeker, Newark, N. J.

863,493. Building block. Richard, Gothard and Arn Arnsen, Escanaba, Mich.

863,757. Concrete block mold. Ernest O. Ricks, Birmingham, Ala.

864,698. Concrete block machine. Geo. W. Schock and Leopold A. Mattes, South Bend, Ind.

865,266. Apparatus for forming building blocks and artificial stone from plastic material. Albert A. Pauly, Youngstown, O.

865,297. Mold for portable wall blocks or sections. Hugh B. Copeland, Denver, Col.

865,454. Machine for making concrete blocks. Wallace G. Tower, Kansas City, Mo.

865,717. Concrete block machine. Frank D. Merchant, Minneapolis, Minn.

866,360. Concrete block. Isaac B. Hill, Plainfield, N. J.

866,571. Block molding machine. Jas. M. Bolton, Washington, D. C.

867,361. Block machine. J. R. Harbeck, Detroit, Mich.

859,142. Fireproof Building and Blocks Therefor. Louis O. Sprout, Fostoria, O.

868,411. Building Block. John Cilek, Los Angeles, Cal.

868,730. Machine for Making Concrete Blocks. Wm. F. Tubesing, Cincinnati, O.

868,838. Concrete Building Block. Henry S. Brewington, Baltimore, Md.

869,271. Machine for Making Building Blocks. Edward H. Somers, Urbana, Ill.

869,436. Machine for Molding Concrete Blocks. Jas. Ingells, Muskegon, Mich.

869,828. Building-Block Mold. Chas. J. T. Cordes, Waldwick, N. J.

870,006. Concrete Block Machine. Chas. Wolfenden, Minneapolis, Minn.

871,385. Mold. Jacob B. Blaw, Pittsburg, Pa.

871,390. Device for Molding Concrete and Other Plastic Materials. Chas. Dietrichs, Little Ferry, N. J.

871,524. Process of and Apparatus for Manufacturing Artificial Stone. Las Pulvermann, Hamburg, Germany.

872,106. Mold for Forming Cement Blocks. Geo. B. Blodgett, Fredonia, N. Y.

872,111. Building Blocks. Wallace L. Dow, Sioux Falls, S. D.

872,333. Concrete Molding Machine. Lewis D. Ewing, Akron, O.

872,364. Cement Block. James S. Pierce, Tacoma, Wash.

873,600. Reinforced Building Block or Slab. Edward C. Poole, Southampton, Eng.

873,849. Process for Making Artificial Stone and the Stone. Harry O. Duerr, Wilmington, Del.

874,230. Machine for Molding Building Blocks. Andrew Nelson, Rock Island, Ill.

874,366. Cement Block Molding Machine. Jas. Layfield and Albert V. Crisp, Vancouver, B. C.

874,533. Block Molding Machine. Milton J. Palmeter, South Bend, Ind.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Davenport, Ia.—The Standard Asphalt & Rubber Co., of Chicago, has completed the asphalt waterproof covering over the Harrison st. bridge of the Rock Island viaduct. The progress of the work attracted considerable attention, as the leakage of the bridge had long been a source of annoyance to the citizens.

CONTEMPLATED WORK.

Philippi, W. Va.—Voted to issue $16,000 bonds for paving.

Davenport, Ia.—Paving is contemplated for E. River and Third sts.

Northfield, Minn.—Council has decided to build street crossings.

Binghamton, N. Y.—Common council has decided to pave Lewis st. with brick.

Des Moines, Ia.—Asphalt paving is contemplated for Clark st. from 11th to 14th.

Bucyrus, O.—Paving is proposed next year for Poplar, Mary and other streets.

Burlington, Ia.—Macadam paving is contemplated for Dill st. J. P. Winters, cy. engr.

Haverhill, Mass.—A resolution has been passed providing for the paving of Locust st.

Bellaire, O.—The county comrs. have decided to pave Bellaire Park at a cost of $42,000.

Abilene, Kas.—About 1 mile of concrete curb and gutter is contemplated. J. A. Graves, cy. clk.

Lynn, Mass.—The county comrs. estimate the cost of constructing Lynnfield st. at $35,000.

Rockford, Ill.—Cy. Engr. Hand estimates the cost of paving Main and State sts. at $73,623.

Verona, N. J.—A resolution has been passed providing for the macadamizing of Lakeside ave.

Coffeyville, Kas.—Plans are being prepared for 10 blocks of brick paving. Rosa Bell, cy. clk.

Hamilton, O.—Plans and estimates have been submitted for resurfacing Main st. L. A. Dillon, cy, engr.

Winfield, Kas.—About 8 blocks of concrete curb and gutter is contemplated. Geo. W. Sloan, cy. clk.

Independence, Kas.—About 20 blocks of brick paving is contemplated. J. W. Kremer, cy. clk.

Roseburg, Ore.—An ordinance has been passed providing for the paving of 18 blocks of streets.

Puyallup, Wash.—A resolution has been passed providing for the paving of Meridian, Stewart and J sts.

Chanute, Kas.—This city contemplates the construction of 14 blocks of brick paving. W. F. Sams, cy. clk.

Joliet, Ill.—A resolution has been passed providing for the construction of asphalt paving in S. Chicago st.

Columbus, O.—Special.—Street paving and grading is contemplated for a large number of streets and alleys.

San Francisco, Cal.—The repaving of Minna st. with basalt blocks is contemplated and the contract will be let soon.

Beardstown, Ill.—Plans are being prepared for about 10 blocks of vitrified brick paving on concrete base. Cy. Clk. Schmitt.

Ft. Smith, Ark.—The property owners in N. 8th st. have decided to petition to the city council for brick paving.

New Albany, Ind.—Estimates for paving Oak and 10th sts. with brick have been prepared by Samuel T. Mann, cy. engr.

Niagara Falls, Ont.—Plans for a macadam boulevard 16 miles in length, from Queen Victoria Park to Ft. Erie, are being prepared.

New Orleans, La.—The question of paving Carrollton ave. for a distance of about 13 miles, at a cost of $800,000, is under consideration.

Crookston, Minn.—A petition has been submitted to the county board asking that a county road be built in the towns of Chester and Hill River.

Denver, Colo.—The construction of a boulevard between 38th and Downing ave. to the Brighton road has been authorized by the board of supervisors.

Lewiston, Idaho.—The city council has authorized the city engineer to prepare specifications for bids for various kinds of hard surface pavement.

Glenwood Springs, Colo.—The construction of an automobile road 40 miles long, from this city to Marble, is contemplated. John C. Osgood is interested.

Ashtabula, O.—City council has authorized the paving of Bank st. with asphalt blocks on gravel foundation, with sand filler, cement curb and gutter. L. A. Amsden, cy. engr.

South Bend, Ind.—Alonzo Hammond, cy. engr., has filed specifications for paving an alley with brick, grading, curbing and constructing cement walks in Roger st. and Portage ave.

Wichita, Kas.—The construction of sidewalks in Wichita and Gilbert sts. and Elizabeth and Glenn aves. is contemplated. A resolution has been passed to pave Main st. R. N. Dorr, cy. clk.

Greenfield, Ind.—The property owners in State st. have filed a petition with the city council and county auditor that the street be paved with brick, under the new township road law.

Newark, N. J.—An ordinance has been passed providing for the repaving of Hill st. with granitoid concrete block on 6-in. concrete foundation. Alfred L. Swain, acting clk. bd. st. and water comrs.

Denver, Colo.—A resolution will be considered Oct. 19 providing for the establishment of Capital Hill Improvement Dist. No. 6, at a cost of $143,564.61. The work will include full-width street grading, constructing concrete curb and gutter, surfacing roadways with smelter slag and disintegrated granite, constructing concrete sidewalks, etc.

Ashtabula, O.—A resolution has been passed providing for the paving of Bank st. with asphalt block on gravel base. H. D. Cook, mayor.

Washington, Pa.—Petitions are being circulated in No. Franklin, So. Franklin and Morris twps. asking the county commissioners to pave Upper Ten Mile plank road with brick.

Joliet, Ill.—Asphalt paving is contemplated for So. Chicago st. from 5th to Seigel st.

CONTRACTS TO BE LET.

Washburn, N. D.—Bids are asked until Sept. 8 for grading a road. O. B. Wing, co. audt.

Huntington, Ind.—Bids are asked until Sept. 18 for constructing a gravel road. Co. comrs.

Youngstown, O.—Bids are asked until Sept. 3 for paving West ave. W. H. McMullin, clk. B. P. S.

Frankfort, Ind.—Bids are asked until Sept. 14 for constructing 29 gravel roads. Bd. co. comrs.

Racine, Wis.—Sealed bids are asked until Sept. 12 for grading sundry streets. P. H. Connolly, chm. B. P. W.

Osceola, Ia.—Bids are asked until Sept. 7 for constructing 6,500 ft. of cement walks. W. N. Temple, cy. clk.

Terre Haute, Ind.—Bids are asked until Sept. 5 for constructing a stone macadamized road. N. G. Wallace, co. audt.

Vincennes, Ind.—Sealed bids are asked until Sept. 11 for constructing granitoid walks and stone curbing. B. P. W.

Cincinnati, O.—Sealed bids are asked until Sept. 11 for graveling Mt. Hope road. Stanley Strubble, prest. co. comrs.

Jacksonville, Fla.—Bids are asked until Sept. 9 for paving about 1 mile of New York ave. C. Benedict, chmn. co. comrs.

Ashland, Wis.—Bids are asked until Oct. 10 for macadam paving in the town of Shanagolden. Town clk. of Shanagolden.

Cincinnati, O.—Sealed bids are asked until Sept. 4 for repairing Blue Ash ave. and Plainfield Pike. Fred Dreihs, co. clk.

Bloomington, Ind.—Bids are asked until Sept. 9 for constructing a macadamized road in Van Buren twp. Samuel M. Kerr, co. audt.

Muncie, Ind.—Sealed bids are asked until Sept. 9 for grading, draining and paving public highways. Jos. E. Davis, co. audt.

Danville, Ind.—Bids are asked until Sept. 7 for constructing 10,968 ft. of road in Washington twp. Wm. H. Nichols, co. audt.

Mankato, Minn.—Sealed bids are asked until Sept. 7 for constructing Cable Mill Hill and Rapidan Mills Hill roads. Co. audt.

Martinsville, Ind.—Bids are asked until Sept. 8 for constructing gravel roads in Brown and Jefferson twps. B. E. Thornburg, co. audt.

Lafayette, Ind.—Sealed bids are asked until Sept. 10 for constructing gravel roads in Wabash and Tippecanoe twps. John P. Foreman, co. audt.

Decatur, Ind.—Sealed bids are asked until Sept. 7 for macadamizing roads in Wabash, Hartford and Washington twps. C. D. Lewton, co. audt.

Vincennes, Ind.—Bids are asked until Sept. 8 for constructing gravel roads in Vincennes, Decker and Washington twps. John T. Scott, co. audt.

Toledo, O.—Sealed bids are asked until Sept. 5 for draining, grading and macadamizing 1½ miles of county road. E. M. Goder, clk. of Monclova twp.

Chattanooga, Tenn.—Sealed bids are asked until 2:30 p. m. Sept. 1 for paving Rossville ave. with vitrified brick. H. F. Van Dusen, chmn. B. P. W.

Dublin, Ga.—Bids are asked until Sept. 3 for constructing 17,200 sq. yds. of vitrified brick, wood block and bitulithic pav-

ing. Mayor and bd. of councilmen.

Liberty, Ind.—Sealed bids are asked until Sept. 7 for grading, draining and paving with gravel 2.98 miles of highway in Union twp. Clinton Gardner, co. audt.

Waukegan, Ill.—Sealed bids are asked until Sept. 11 for paving 1 mile of Marion st. with brick. W. S. Bullock, prest. bd. local impvts.; Fred W. Churchill, secy.

Fond du Lac, Wis.—Sealed bids are asked until Sept. 5 for constructing cement sidewalks, curb and gutter in Military and Union sts. E. P. Fitzgerald, chmn. B. P. W.

Tipton, Ind.—Sealed bids are asked until Sept. 7 for constructing gravel roads in Madison, Cicero, Prairie and Liberty twps. C. E. Ryker, chmn. co. comrs.; J. F. Barlow, aud.

Lewiston, Idaho.—Sealed bids are asked until 8 p. m. Sept. 4 for 54,000 sq. yds. of hard surface pavement, with combined curbs and gutters. John E. Nickerson, cy. clk.

Jamesburg, N. J.—Bids are asked until Sept. 2 for constructing a macadam road in the grounds of the State Home for Boys. Peter Forman, engr., Englishtown, N. J.

Fort Mackenzie, Wyo.—Sealed bids are asked until Sept. 5 for constructing macadam roads, curbs, drains and gutters here. L. E. Hohl, 2nd Lieut. 19th Infantry, Constr. Q. M.

Wauseon, O.—Sealed bids are asked until Sept. 4 for grading, curbing, paving and constructing retaining walls, culverts, gutters, etc., in Leggett st. L. H. Deyo, vil. clk.

Rockville, Ind.—Sealed bids are asked until Sept. 8 for constructing a certain gravel road in Penn and Washington twps. Samuel Coble, chmn. co. comrs.; H. A. Henderson, co. audt.

Corydon, Ind.—Sealed bids are asked until Sept. 8 for constructing a free gravel or macadamized road in Jackson twp. Thomas J. Stevens, chmn. co. comrs.; F. E. Watson, co. audt.

Decatur, Ala.—Bids are asked until Sept. 14 for constructing a system of macadam roads. Plans and specifications for the first 30 miles will be ready after Sept. 1. W. E. Skeggs, judge of probate.

Cleveland, O.—Sealed bids are asked until Sept. 12 for grading, draining and improving River road in West Park twp. to West Madison ave. in Rockport twp. Bids are asked until Sept. 19 for improving Canal road. Wm. F. Black, clk. co. comrs.

Brooklyn, N. Y.—Bids are asked until Sept. 2 for grading and repaving with asphalt, asphalt block or granite on concrete base, certain streets. Also, for regulating curbing and constructing sidewalks in 57th st. Bird S. Coler, boro prest.

Pascagoula, Miss.—Sealed bids are asked until Sept. 2 for constructing about 100,000 sq. ft. of concrete sidewalk, 20,000 lin. ft. of concrete combined curb and gutter and necessary crossings and culverts. Mayor and aldermen; W. G. Kirkpatrick, cons. engr., Jackson, Miss.

Logansport, Ind.—Sealed bids are asked until Sept. 8 for constructing the Philip Noah road. Geo. W. Cann, co. audt.

New Castle, Ind.—Sealed bids are asked until Sept. 7 for constructing 3 mls. of public highway. Chas. Mohler, chrm. co. comrs.; Wm. L. Rusk, co. audt.

CONTRACTS AWARDED.

Baltimore, Md.—Fisher, Riley & Corraza secured the contract for improving Falls Road, for $20,273.

Muncie, Ind.—The contract for constructing a gravel road was awarded, Aug. 6, to John Gubbins, for $34,396.

Superior, Wis.—The contract for paving Hammond st. was awarded to Russell & Holmquist, for $20,158.

Princeton, Ill.—The contract for paving Main st. was awarded to the Crescent Constr. Co., of Peoria, for $10,975.

Iola, Kas.—The contract for 3400 sq. yds. of macadam paving was awarded to R. S. Gilfillan, of this city, Aug. 11.

Bellingham, Wash.—The contract for paving Potter st. with asphalt was awarded to Charles E. Lind, for $19,350.80.

Newark, N. Y.—The contract for paving S. Main st. with brick was awarded to A. A. Bennett, 184 Jones st., Rochester, N. Y.

Pasadena, Cal.—The contract for paving about 2 miles of streets was awarded to the Fairchild-Gilmore-Wilton Co. for $67,410.

Scottsboro, Ala.—The contract for constructing 3 miles of pike was awarded to John H. Williamson and J. R. Webb, for $6,360.

Kansas City, Kas.—The contract for resurfacing with asphalt 6th st. was awarded to the R. J. Boyd Constr. Co., at $1.87 a sq. yd.

Knoxville, Tenn.—A contract for constructing 14 miles of pike was awarded to John L. O'Connor, of this city, for about $26,000.

Towner City, N. D.—The contract for constructing cement walk crossings and curbs was awarded to W. J. Curren, of Valley City, N. D.

Iowa City, Ia.—The contract for paving Harrison, Church, Fairchild, Davenport and Gilbert sts. was awarded to Wm. Horrabin for $41,947.

Anacortes, Wash.—The contract for work in the 4th st. improvement district was awarded to Rodgers & McElmon, of Bellingham, for $3,602.

Robinson, Ill.—The contract for paving 5 streets with brick was awarded to Allen Jay Parish & Bro., of Paris, Ill., at $1.61 a sq. yd.

Clinton, Ind.—The contract for constructing 41,000 sq. ft. of sidewalks was awarded to Foulkes & Forbes, of Terre Haute, for $4,152.

Oklahoma City, Okla.—The contract for constructing sidewalks was awarded to M. F. Crawford at 11 cts. for cement and 9½ cts. for brick paving.

Windber, Pa.—The contract for paving and macadamizing 4,396 ft. of state road was awarded to J. E. Francis & Co., of Punxsutawney, Pa., for $14,178.

Xenia, O.—The contract for improving Hargrave road was awarded to Herbert Nash at $1.66 a sq. yd.

Fostoria, O.—The contract for macadamizing Columbus ave. was awarded to Lee & Peter, of this city, for $18,200.

St. Joseph, Mo.—Rackliffe & Gibson secured the contract for paving 8th st. with Hassam pavement, at $1.75 a sq. yd.

Lawton, Okla.—The contract for constructing 45 blocks of street paving was awarded to Chas. H. Shaw, of Muskogee, Okla.

Van Buren, Ark.—The contract for grading and paving 10,000 sq. yds. of streets was awarded to W. R. Petty, of Pine Bluff.

Oshkosh, Wis.—The Andrews Asphalt Co., of Hamilton, O., secured the contract, Aug. 8, for paving Jackson st., for $16,000.

Seattle, Wash.—The contract for constructing concrete sidewalks in Bayview st. and other streets was awarded to the Coast Concrete Co., for $33,620.

Hull, Que.—The contract for paving

Main and Alma sts. and Laurier ave. was awarded to the Ottawa Constr. Co., of Ottawa, Ont., for $45,000.

Fond du Lac, Wis.—The contract for 10,000 sq. yds. of paving in S. Main st. was awarded to the McArgo Constr. Co., of this city, for $16,941.

Woodfield, O.—The contract for paving Church and Washington sts. was awarded to Chas. Berry at $1.30 a sq. yd. for paving and 45 cts. a lin. ft. for curbing.

Jersey City, N. J.—The contract for rebuilding a section of county road near Highwood Park was awarded to J. F. Murphy, of West Hoboken, for $18,850.

Hackensack, N. J.—The contract for macadamizing the Patterson plank road was awarded to the B. M. Shanley Co., 26 Exchange Place, Jersey City, for $148,-700.

Great Barrington, Mass.—The contract for constructing 4,000 sq. ft. Mack block paving was awarded to Hoflick & Co., of North Adams, at $2.43 a sq. yd.

Waynesburg, Pa.—The contract for constructing 11,000 sq. yds. of brick paving was awarded, Aug. 5, to the Hallam Constr. Co., of Washington, Pa., for $30,-000.

East St. Louis, Ill.—The Myers Constr. Co. secured contracts, Aug. 11, as follows: Granite paving in Missouri ave., $33,166; brick paving, 2nd st., $9,568.

Milwaukee, Wis.—Paving contracts were awarded recently as follows: River st., Hase & Weiher, $1.92 a sq. yd.; 4th st., Badger Constr. Co., $1.91 a sq. yd.

Chicago, Ill.—The contract for constructing a county road on State st. bet. 79th and 95th sts., a distance of about 2 miles, was awarded to W. L. Thompson, for $20,000.

Sonyea, N. Y.—The contract for constructing a public highway across the Craig Colony estate has been awarded to McCarthy & Simerson, of Mt. Morris, N. Y., for $10,917.

Chippewa Falls, Wis.—The contract for constructing 2,700 sq. ft. of brick paving in Prairie st. and Jefferson ave. was awarded to Wooley & Hanson, of La Crosse, at $2.43 a sq. ft.

Lynchburg, Va.—The contract for constructing 1,500 sq. yds. of concrete sidewalks was awarded to A. J. Miller & Son, of Lynchburg, at $1.06 for sidewalks and 30 cents for excavating.

Dubuque, Ia.—Paving contracts have been awarded as follows: Brick paving, Locust st., M. Tschirgi & Sons, $5,635; improving Pleasant st., $2,444, and Hennepin st., $1,528, Peter Eisbach.

Salt Lake City, Utah.—Special.—Louis C. Kelsey, cy. engr., advises us that the bids submitted Aug. 14 for grading, curbing and gutters in paving extension No. 18 were rejected and readvertised.

Philipsburg, N. J.—George M. French, of Somerville, was awarded the contract for constructing Morris Turnpike, for $9,796, and the Mile Tische Co. the contract for the New Brunswick Turnpike, for $9,213.

Nashville, Tenn.—Contracts for grading, macadamizing streets have been awarded as follows: Coffee and Nassau sts., Quinn & Ellis, $1,764.60 and $1,474.30 respectively; Cockrill st., J. A. Webb, $2,-588.15.

Astoria, Ore.—Contracts for street improvements have been awarded as follows: 8th st., Chris Larson, $1,070; Irving ave., Chris Larson, $517; 12th st., E. A. Gerding, $1,720; 23rd st., Birch & Jacobson, $1,832.

Jacksonville, Fla.—The contract for 10,-000 sq. yds. of brick paving and 5,500 lin. ft. of stone curb in 4th st. and Myrtle ave. was awarded to the Georgia Engineering Co., of Augusta, Ga., at $7.51½ a sq. yd.

Topeka, Kas.—The contracts for paving Locust st. and repaving E. 6th ave. were awarded to Wm. W. Gilmore for $8,717 and $12,094 respectively. Littlejohns & Folks secured the contract for curbing and gutter for $4,635.

Brookville, Ind.—The contract for constructing 90,912 sq. ft. of sidewalks was awarded, Aug. 13, to Thornbury & Murdock, of Sullivan, at 9½ cts. a sq. ft.; 4,620 lin. ft. curb and gutter, 33 cts.; 10,040 lin. ft. crossings, 10 cts.

Windfall, Ind.—The contracts for constructing 17 free gravel roads were awarded, Aug. 5, to Chas. Kinder, Porter & Bowlin, J. F. Morris, Duncan & Hodson, C. V. Todd, Edward Becker, C. M. King, John Kleyla, Henry Roller, B. W. Coff.

Yonkers, N. Y.—Contracts for regulating and grading streets were awarded, Aug. 3, as follows: Morningside ave., Charlton & Weston, $7,645; Van Sice ave., M. J. Callahan, $7,300; Cliff st., McDonald & Murray, $8,975; Spruce st., Kearns & Hart, $5,900.

Mobile, Ala.—Special.—The contract for 34,712 sq. yds. of wood block paving was awarded to Jett Bros., of this city, for $80,681.28. Jett Bros. also received the contracts for 2,902 sq. yds. of brick paving for $7,717.22, and 11,744 lin. ft. cement curbing for $4,110.40.

Port Chester, N. Y.—The contracts for paving S. Main st. and Willet ave. with bitulithic on concrete were awarded to Warren Bros. Co., of Boston, for $42,663 and $21,524 respectively. The contract for paving Highland st. and Locust ave. with brick was awarded to F. E. Murray for $17,584.

Selma, Ala.—The contract for paving 7 blocks of Water st. with vitrified brick was awarded to the Crockett Paving Co., of Birmingham, Ala., for $48,647, and for paving 3 blocks of Broad st. with asphalt to the Memphis Asphalt & Paving Co., of Memphis, Tenn., for $33,979.

Hartford, Conn.—The contract for constructing a macadam road on Connecticut Boulevard was awarded to R. B. Davis, of this city. Contract for constructing 5,770 lin. ft. of graded road, in 3 sections, in the town of Cornwall, was awarded to Trumbull & Fabri, of Litchfield, Conn., for $8,367.

Chicago, Ill.—Paving contracts were awarded Aug. 10 as follows: Granite block paving in S. Halstead st., vitrified brick in Higgins ave., and limestone in S. May st., Standard Constr. Co.; limestone in W. 74th st., A. J. McAllister; vitrified brick, 55th st., Inter Ocean Paving & Construction Co.

Chicago, Ill.—Bids were submitted Aug. 17 for furnishing and laying 550 cu. yds. of concrete base, 3,150 sq. yds. of granite block wearing surface on Central Row, American Row, and State st., as follows: Southern New England Paving Co., for granite block pavement, with 1 year's guarantee, was $2.54 a sq. yd. to $2.00 a sq. yd., according to stone used, and $6.35 a cu. yd. for concrete; sheet asphalt, $1.65 a sq. yd., including a 5-year guarantee. A. W. Byrne, $2 a sq. yd. for sheet asphalt under a 5 year's guarantee; granite block, 1 year's guarantee, $3.10 a sq. yd.; concrete, $6.25 a cu. yd.

Hartford, Conn.—Contracts were awarded Aug. 11 for state road work as follows: Pearson Eng. & Constr. Co., of Bristol, for 965 lin. ft. of macadam road and 355 lin. ft. of telford in Bristol at $1.25 and $1.75 a ft., respectively; cobble

stone gutters, 60 cts. a sq. yd.; macadam road, 5,645 ft. long in Avon to the Connecticut Constr. Co., of Middletown, for $1.22 a lin. ft.; cobble stone gutters, 70 cts. a sq. yd.; also 5,639 lin. ft. of macadam telford road in Simsbury at $2.09 per lin. ft. for macadam and $3.30 per lin. ft. for telford; A. C. Sternberg & Son, of West Hartford, 1,725 ft. of macadam road in Avon, $1.18 a lin. ft., and 600 lin. ft. of telford for $1.50 per ft.

Waukegan, Ill.—Contracts for street paving were awarded, Aug. 5, as follows: Macadam paving, Clayton st., H. C. Patterson, of this city, $2,078.50; brick paving, Madison st., James Cape & Sons, of Racine, Wis., for $8,135.50; brick, another section of Clayton st., Jas. Cape & Sons, Racine, $3,080.10; brick, Clayton st., H. C. Patterson, city, $2,107.10; brick, Clayton st., Jas. Cape & Sons, Racine, $4,727.50; cement sidewalks with reinforced concrete retaining walls and drain, Thomson & Smart, city, $4,223.35.

Grand Forks, N. D.—Special.—The contract for constructing 48,000 sq. yds. of creosoted block paving, for which bids were received July 23, has been awarded to P. McDonnell, of Duluth, Minn., as follows: Creosoted blocks, $1.715 a sq. yd.; Portland cement, $1.70 per bbl.; common labor, $2 per 10 hours; gravel, $1.55 a cu. yd.; sand for intersection, 25 cts. a cu. yd. plus 1 mile haul.

New York City—Contracts have been awarded in the borough of Richmond as follows: Regulating and repaving with vitrified brick on concrete base, Lafayette, Sharp and Maple aves., Elm st. and Townsend ave., Wm. J. Quinlan, Port Richmond, $15,623; bituminous concrete on creosote, N. Y. ave., Fingerboard road and Grant st., John E. Donovan, of Port Richmond, $69,528; bituminous concrete on present foundation, Henderson ave., Uvalde Asphalt Paving Co., 1 Broadway, N. Y. City, $52,615; vitrified brick paving on concrete base, gutters of Prospect, Britton and South sts. and Van Pelt ave., Wm. J. Quinlan, of Port Richmond, $17,507; 7th, 6th, 5th, 3rd, 2nd and 1st ave. gutters, Ronacci & Vincelli, 672 DeGraw st., Brooklyn, $19,732.

St. Louis, Mo.—Paving contracts have been awarded as follows: Minnesota st., Wm. R. Bush Constr. Co., Holland Bldg., $10,766; Gano st., James T. McMahon, $9,041; Hull Place, Webb-Kunze Constr. Co., Fullerton Bldg., $3,380; Humphrey st., Gustavus A. Heman, Holland Bldg., $15,082; Maffit st., Hanick Quarry & Constr. Co., Liggett Bldg., $13,044; Brannon st., Webb-Kunze Constr. Co., $10,708; Pulaski st., G. Everman & Bro., 5100 Virginia st., $4,707; Third st., Webb-Kunze Constr. Co., $11,186; Oregon st., G. Evermann & Bro., $5,485; Lambdin st., Hanick Quarry & Constr. Co., $6,755; Lambdin st., Hanick Quarry & Constr. Co., $10,490; Sullivan st., William H. Redemeyer, North Ninth st., $12,756; Juniata st., William R. Bush Constr. Co., $24,317; Eighth st, from Franklin to Biddle st., Herman Constr. Co., $9,288. All of the above streets except Eighth st. are to be paved with brick. Eighth st. is to be paved with granite.

Charleston. S. C.—The contract for 30,000 sq. yds. of brick paving was awarded to Bowe & Page, of Augusta, Ga., Aug. 18, at $1.44 a sq. yd. or $43,200.

Galion, O.—Special. The lowest bid submitted July 27 for paving W. Main st. was that of P. Drake & Sons, of Marion, O., and the contract will probably be awarded to them for $32,184.42. Logan brick with cement and tar fillers decided upon.

SEWERS.

South Orange, N. J.—Henry F. Trimpi, Matthew W. Hogan and Warren P. Ball have been appointed commissioners to levy assessments for the cost of the sewer systems in the South Orange Heights and Maplewood sections.

CONTEMPLATED WORK.

McKinley, Minn.—A sewer system is contemplated.

Chisholm, Minn.—A sewer in Central ave. is contemplated.

Katonah, N. Y.—A sewerage system is contemplated.

Jacksonville, Fla.—A new sewerage system is proposed.

Farmer City, Ill.—Estimates are being prepared for a new sewer system.

Bellefonte, Pa.—Plans will be made within a year for a sewage disposal plant.

Martins Ferry, W. Va.—The question of a new sewerage system is being considered.

Rochester, Minn.—Plans have been accepted for constructing a sewer in Grove st.

Merrill, Wis.—Bids will be asked for constructing a number of sewers.

Hope, Ark.—A new sewerage system is contemplated at a cost of about $250,000.

Gothenburg, Neb.—Voted to issue $7,000 bonds for constructing a sewerage system.

Selma, Cal.—The construction of 2½ miles of sewers is recommended by Mayor Atkins.

Wallace, Idaho.—About $10,000 will be expended for constructing new sewers. Cy. clk.

Topeka, Kas.—An ordinance has been passed to construct sewers in the Kenwood Dist.

Rockford, Mich.—Plans are being prepared for the reorganization of the sewer system.

St. Joseph, Mo.—Voted to issue bonds for constructing sewers. Geo. F. Barnes, secy. B. P. W.

Huron, S. D.—Voted to issue $60,000 bonds for the construction of an aqueduct sewerage system.

Independence, Kas.—The construction of a vitrified pipe sewer is contemplated. J. W. Kremer, cy. clk.

Kendallville, Ind.—Bids will be asked soon for constructing a sewerage system. Wm. P. Myers, cy. clk.

East Lansing, Mich.—About $53,000 will be expended for constructing sewers and drains. Geo. Martin, cy. clk.

Coffeyville, Kas.—The installation of a septic tank for sewer No. 1 is contemplated. J. H. Wilcox, mayor.

Chanute, Kas.—The construction of 3 blocks of vitrified pipe sewers is contemplated. W. F. Sams, cy. clk.

Forney, Ala.—Bonds have been voted and the city will have plans prepared soon for constructing a sewerage system.

South Bend, Ind.—Alonzo Hammond, cy. engr., has filed specifications for the construction of a pipe sewer in 6th st.

Butte, Mont.—The sewer committee has recommended the construction of a sanitary sewer in Aluminum st. Mayor Corby.

Delaware, O.—The city council has under consideration the construction of a sewage disposal plant. Geo. S. Irwin, cy. engr.

Middletown, Pa.—Plans for a sewage disposal plan for this city will be prepared by engineers from the state health department.

Benton Habor, Mich.—Sewer Contr. Richardson has been directed to prepare

plans for a sewer in Benton st., Highland ave. and 9th st.

Circleville, O.—Plans for a sewage purification plant for the Piekaway County Infirmary here have been approved by the state bd. of health.

Birmingham, Ala.—Plans are being prepared for the construction of sewers throughout the entire city, by Julian Kendrick, former city engineer.

Denver, Colo.—The construction of a sanitary sewer that will eventually cost $4,400,000 is contemplated. W. B. Lowry, prest. B. P. W.

Highland Park, Ill—An ordinance is being prepared for constructing a purification plant and a system of reinforced concrete sanitary sewers.

Grundy Center, Ia.—Plans for a sewerage system will be prepared by the Iowa Engineering Co., of Clinton, and bids will be asked as soon as they are completed.

St. Augustine, Fla.—The citizens of North City have petitioned the city council of this city to construct a sewerage system in that section of the city.

Urbana, O.—Council has voted to have a resolution prepared providing for the issue of $30,000 bonds with which to begin the construction of a sewerage system.

Sioux City, Ia.—Plans have been prepared for the Bacon Creek sewer by G. Y. Skeels, cy. engr. The plans provide for 2,500 ft. of concrete or brick conduit, at a cost of $54,445.

Binghamton, N. Y.—The state dept. of health is urging the establishment of sewage disposal plants in all the towns and villages in the Susquehanna Valley, including Binghamton and Elmira.

Sea Bright, N. J.—A resolution has been adopted by the state bd. of health asking the boroughs of Atlantic Highlands and Sea Bright to install purification plants in connection with their sewerage systems.

Ashtabula, O.—City council voted to proceed at once with the completion of plans for laying out and biulding main trunk sewers in a new district in the west part of this city to be known as No. 3. L. A. Amsden, cy. engr.

Auburn, Neb.—Special. This city will submit to vote the question of issuing bonds for constructing water-works and sewerage systems, and desires from contractors bids and plans for such systems not to exceed $65,000. For particulars address W. H. Bousfield, cy. clk.

Paterson, N. J.—This city is considering a proposition made by a New York sewage disposal company to build a plant for this city for $2,000,000, the city to pay for the work when the plant is completed and in satisfactory operation. The proposition will be considered Sept. 10 by the bd. of finance and the special sewerage committee.

Lansing, Mich.—Voted to issue bonds for the construction of sewerage and water systems in East Lansing.

Galion, O.—Special. Bids will be asked in a few weeks for constructing an intercepting sewer and sewage disposal plant. Appropriation $58,000, Bradbury & Shute, cons. engrs., Columbus, O.

CONTRACTS TO BE LET.

Cloquet, Minn.—Bids are asked until Sept. 7 for constructing 660-ft. of sewer. Jos. Loisel, cy clk.

Hudson, Wis.—Bids are asked until Sept. 8 for constructing a sewer in 2nd st. A. Karrass, cy. clk.

Appleton, Wis.—Bids are asked until Sept. 2 for constructing a sewer in College ave. E. L. Williams, cy. clk.

Point Pleasant Beach, N. J.—Sealed bids are asked until Sept. 3 for constructing sewers and drains. J. M. Vannote, mayor.

Evansville, Ind.—Bids are asked until Sept. 7 for constructing 7 blocks of pipe sewers. Walter Wunderlich, clk. B. P. W.

Lewiston, Idaho.—Sealed bids are asked until 8 p. m. Sept. 4 for constructing a drainage system. John E. Nickerson, cy. clk.

Brooklyn, N. Y.—Bids are asked until Sept. 2 for constructing a sewer in Prospect Place. Bird S. Coler, prest. boro.

Mitchell, S. D.—Bids are asked until Sept. 7 for constructing a storm sewer or drain with outlet in the Dry Run. L. L. Ness, cy. audt.

Hackensack, N. J.—Sealed bids are asked until Sept. 8 for constructing a sewer in Poplar ave. E. Phillips, clk. Hackensack Impvt. Comn.

Algona, Ia.—Sealed bids are asked until Sept. 17 for constructing tile drains in drainage district No. 33. A. L. Anderson, co. audt.

Marshalltown, Ia.—Sealed bids are asked until Sept. 10 for constructing Marshall drainage ditch No. 3. Erastus Cornell, co. audt.

North Braddock, Pa.—Bids are asked until Sept. 4 for constructing a sewer in Maple ave. C. A. Stewart, boro engr., Municipal Bldg.

Brooklyn, N. Y.—Bids are asked until Sept. 9 for constructing sewers in E. 98th st., sections 1 and 2, and in 85th st. Bird S. Coler, prest. boro.

Carroll, Ia.—Bids are asked until Sept. 8 for constructing 1,240 ft. of 10-in., 13,700 ft. of 8-in. and 4,930 ft. of 6-in. subdrain and appurtenances. J. A. Dougherty, cy. clk.

Washington, D. C.—Bids are asked until Sept. 14 for furnishing vertical compound engines at the sewerage pumping station. H. B. F. MacFarland, chmn. Dist. Comrs.

Crookston, Minn.—Bids are asked until Sept. 8 for constructing a 24-in. sewer in Alexandria st., 15-in. in Manitoba and 9-in. in Summit ave. A. M. Childs, cy. clk.

Washington, D. C.—Bids are asked until Sept. 2 for constructing section 2 of East Side intercepting sewer, boundary to Brookland. H. B. F. MacFarland, chmn. Dist. Comrs.

Ft. Sam Houston, Tex.—Bids are asked until Sept. 3 for constructing water, sewerage and drainage systems for the new cavalry addition here. L. J. Fleming, constr. Q. M.

Dayton, O.—Bids are asked until Sept. 4 for constructing storm sewers in Germantown st. and tributaries of the Norwood, Linwood and Bolander aves. storm sewers. W. A. Budroe, clk. B. P. S.

Lawrence, Kans.—Sealed bids are asked until 5 p. m. Sept. 1 for constructing a main sanitary sewer in the east and southeast portions of this city, requiring 6,000 ft. of 12-in. vitrified sewer pipe and 2 brick manholes. Bids will also be received for constructing 1,500 ft. of combined storm water and sanitary sewer in North Lawrence. F. D. Brooks, cy. clk.

Peoria, Ill.—Bids are asked until Sept. 15 for constructing the west section of the North Peoria sewer, to consist of main brick and vitrified tile, and an outlet brick sewer. E. A. Furry, prest. bd. local impvts.

Cresco, Ia.—Sealed bids are asked until Sept. 7 for constructing 2,875 ft. of sewer, 6 manholes and 1 flushtank, with 2,475 ft. of 4-in. agricultural tile to be laid in the same trench. H. G. Addie, chmn. sewer com.

Vicksburg, Miss.—Sealed bids are asked

until Sept. 7 for constructing a complete system of house sewers, approximating 30 mis. of 8 to 27-in. pipe sewers, 400 manholes and 100 flushtanks. P. M. Harding, mayor; Walter G. Kirkpatrick, cons. engr., Jackson, Miss.

Guayaquil, Ecuador, S. A.—Bids are asked until Dec. 1 for paving and sewerage work. For further information apply to International Bureau of American Republics, 2 Jackson Place, Washington, D. C., or Consul General of Ecuador, 11 Broadway, N. Y. City.

Champaign, Ill.—Bids are asked until Sept. 12 for cleaning out the east main open ditch in special drainage district. Abram Christ, chmn. comrs. Kaskaskia special drainage dist.

Dayton, O.—Sealed bids are asked until Sept. 4 for cleaning 3 mis. of storm water sewers. J. C. Ely, prest. B. P. S.

CONTRACTS AWARDED.

Fairbury, Neb.—The contract for constructing 3,000 ft. of sewer was awarded to Lang & Browitt.

Cleveland, O.—The contract for constructing a sewer in E. 18th st. was awarded to Beers & Doolittle, Aug. 7.

Pontiac, Mich.—The contract for constructing a sewer in S. Saginaw st. was awarded to Lennane Bros. for $3,025.

Cedar Rapids, Ia.—The contract for constructing storm and sanitary sewers was awarded to M. Ford for $10,000.

Sedalia, Mo.—Dean Bros. secured the contract, Aug. 3, for constructing a sewer in sewer dist. No. 411, for $9,000.

Bemidji, Minn.—The contract for sewer extensions was awarded to Bosworth Bros., of Ada, Minn., at $1.38 a lin. ft.

Springfield, O.—Huonker & Williams secured the contract, Aug. 7, for constructing the Indian Run intercepting sewer, for $30,584.

Fergus Falls, Minn.—The contract for building sewers in Cascade st. and Summit ave. was awarded to F. H. Gray for $1,083.

Dunmore, Pa.—The contract for building a sewer in Quincy st. was awarded to the Engineering and Construction Co. of Scranton, Pa.

Aberdeen, S. D.—The contract for constructing the East Side sewer system was awarded to James Kennedy, of Fargo, N. D., for $28,311.

Gates, N. Y.—The contract for constructing a sewer in Jay st. was awarded, Aug. 13, to Wm. Fuller, of Rochester, N. Y., for $20,936.

Newton, Miss.—The contract for installing a sewerage system and septic tank was awarded to Sullivan & Long, of Bessemer, Ala., for $3,836.

Dickson City, Pa.—The contract for constructing a sewerage system was awarded to Stephen Flanagan & Son, of Scranton, for about $50,000.

Canajoharie, N. Y.—The contract for constructing storm sewers was awarded, Aug. 17, to Goodale & Jemison, of Schenectady, N. Y., for $3,052.

Beloit, Wis.—The contract for constructing the East Side sanitary sewer extensions was awarded to G. Maffioli, of Rockford, Ill., for $2,690.55.

Columbia, Miss.—The contract for furnishing pipe to be used in the construction of a sewerage system was awarded to Bosler & Flynn, of Chattanooga, Tenn.

Janesville, Wis.—The People's Construction Co., of Davenport, Ia., was awarded the contract for constructing the main outlet sewer in dists. Nos. 2, 3 and 4, for $57,838.

Reading, Pa.—The contract for constructing an additional filter unit and appurtenances at the sewage disposal plant was awarded, Aug. 6, to S. W. Childs and W. Abbott Witman, for $41,000.

Larned, Kas.—The Thompson Construction Co., N .Y. Life Bldg., Kansas City, Mo., was awarded the contract, Aug. 8, for constructing 21,000 ft. of sewers, for $9,650.

Dayton, Ky.—The contract for constructing trunk sewers in Vine, Main and McKinney sts. was awarded to the Douglass Heating and Plumbing Co., of Cincinnati, for $35,427.

Bath, Me.—The Hanscom Construction Co., 1102 Exchange Bldg., Boston, was awarded the contract, Aug. 10, for constructing 7,000 ft. of sewers, for about $26,000.

Washington, D. C.—The contract for constructing sewers in Arkansas and New Hampshire aves. was awarded, Aug. 17, to the R. J. Beall Construction Co., of this city, for $4,317.

Salt Lake City, Utah.—Special.—Louis C. Kelsey, cy. engr., advises us that the contract for constructing sewer extension No. 200 was awarded to J. D. Hanley, Aug. 14, for $79,992.

Youngstown, O.—Sewer contracts have been awarded as follows: Lydia st., J. L. Edwards, $1,363.35; Mt. Pleasant st., E. Dioro, $1,692.78; W. Woodland ave., W. E. Gartland, $1,666.33.

Boston, Mass.—The contract for constructing a portion of the Stony Brook conduit through Meehan st., in the Forest Hills district, was awarded to Coughlan & Sheils, for $102,200.01.

Mishawaka, Ind.—The contract for constructing a 36-in. sewer in Laurel st. and a 42 and 36-in. trunk sewer of Jackson reinforced concrete pipe, was awarded to G. F. Stoeckinger, for $33,000.

Chicago, Ill.—Contracts for constructing sewers and drains were awarded, Aug. 10, to John A. McGarry & Co., James Fallon, P. J. McNulty, Michael Doran, Emil Dominick, Simon Ryan, Peter Tiritilli, Daniel Hardin.

Boonville, Ind.—Bids for constructing a sewerage system, of brick or cement, were submitted Aug. 5, as follows: Roetzel & Chipman, Boonville, concrete, $47,494.50, brick, $52,012; Charles Pelzer, Boonville, concrete, $57,242.90, brick, $56,160.70; H. G. Roetzel, Boonville, concrete, $52,841.40, brick, $52,012; Foulkes & Forber, Terre Haute, concrete, $42,460.90, brick, $47,160.70; J. J. Dunningan, Shenandoah, Ia., concrete, $55,565.90, brick, $57,264.90; the Newman Sewer Construction Co., Evansville, concrete, $54,190.94, brick, $54,560.40; B. M. Sweeney, New Albany, concrete, $55,256.20, brick, $57,629.70.

WATER WORKS.

CONTEMPLATED WORK.

Wynnewood, Okla.—The water works system will be extended.

Claremont, Minn.—A water works system is contemplated.

Lovell, Wyo.—A water works system is contemplated.

Lodi, N. J.—A municipal water works system is contemplated.

Yankton, S. D.—A new water works system is contemplated.

Bemidji, Minn.—Voted to issue bonds for constructing a water works system.

Winlock, Wash.—The establishment of a water works system is contemplated.

Jamestown, N. D.—Plans are being considered for an additional water supply.

Deary, Idaho.—Surveys are being made for a water works system.

Decatur, Neb.—The question of constructing a water works system is being agitated.

Quanah, Tex.—City council is considering a petition for a water works system.

Covington, Ga.—Will vote Sept. 10 on the issue of $60,000 water works and sewerage bonds.

West Point, Ga.—A new pump may be installed at the city water works station. J. T. Johnson.

Hamburg, N. Y.—This town, West Seneca and Blasdell contemplate the construction of water works.

Shortsville, N. Y.—The question of constructing a water works system was favorably voted on.

Lansing, Mich.—The 6-in. water mains will be extended in Maple, Logan, Lathrop and Jerome sts.

Rock Island, Ill.—A new centrifugal pump at the reservoir station is proposed. Mayor Schaffer.

Iola, Kas.—Plans are being prepared for a concrete settling basin. C. A. Wendorff, cy. clk.

Catasauqua, Pa.—A municipal water works system is contemplated.

Lexington, Tenn.—The construction of a water works system is contemplated.

Sherman, N. Y.—Plans are being prepared for a new water works system.

Newcastle, Ind.—Plans are being prepared for constructing a reservoir.

Mesa, Ark.—Voted to issue bonds for constructing a water works system.

Gothenburg, Neb.—Voted to issue bonds for constructing water works.

Joseph, Ore.—The question of constructing a water works system is under consideration.

Mankato, Minn.—Plans for improving the water supply will be made by John Wilson, of Minneapolis.

Sacramento, Cal.—Mayor White has recommended the installation of a new pump at the water works.

Minnesota Lake, Minn.—The village council has authorized the construction of a water works system.

Coffeyville, Kas.—The erection of a filtration system is contemplated. J. H. Wilcox, mayor.

Frederick, Md.—The construction of a 15-in. water main parallel to the present 8-in. main is contemplated.

Wilmington, Del.—Bids may be asked about Sept. 1 for constructing slow sand filters. John A. Kienle, ch. engr. water dept.

Cohoes, N. Y.—Specifications have been prepared for constructing a mechanical filtration plant. A. T. Kniffin, supt. bd. water comrs.

Medway, Mass.—The water com. is in favor of installing a pumping station and the employment of an engineer to supervise its construction.

Stillwater, Okla.—Plans are being prepared for a water works and filter plant. D. B. Merry, cy. engr.

Austin, Tex.—Plans are being prepared for a reinforced concrete pumping station for municipal water works.

Ocilla, Ga.—Voted to issue $15,000 bonds for the extension of the water works mains and a city hall.

Independence, Kas.—Preliminary plans are being made for a concrete settling basin. J. W. Kramer, cy. clk.

Marcellus, N. Y.—Voted to issue bonds for constructing a water works system. E. D. Smalley, engr., Syracuse.

Madisonville, Ky.—Plans are being prepared for constructing a water works and sewerage system. I. N. Vickes, mayor.

Newport, Ore.—An additional water supply system has been planned by M. Wygant, cy. engr. The question will be voted on soon.

Minneapolis, Minn.—The water committee voted, Aug. 11, to extend the water mains in B and Polk sts. and Vincent and Knox aves.

Wichita, Kas.—Plans are being prepared for a 300,000-gal. cement reservoir here for the Kansas City, Mexico & Orient R. R., Kansas City, Mo.

Toronto, Ont.—Plans and specifications for the filtration plant to be installed by the city will be made by Allen Hazen, of New York City.

Kewanee, Ill.—An ordinance has been adopted for installing 1 mi. of water mains in the southwest part of the city, in Rose, Franklin, Prospect, Birch, Pine and Beach sts.

Hamilton, Ont.—The question of authorizing the expenditure of $88,000 for extensions to the water works system will probably be submitted to the local ratepayers.

Webster, N. Y.—The taxpayers have authorized the village bd. to engage an engineer to investigate and prepare plans for piping the water from Borkhuis Springs, in Penfield, to this city.

Fort William, Ont.—The question of authorizing the expenditure of $95,000 for improvements and extensions to the water works system will be submitted to the local ratepayers.

Saskatoon, Sask.—Plans for the proposed sedimentation basin to be installed in connection with the city water works have been submitted to the city council by George H. Power, resident cy. engr.

Lansing, Mich.—Plans for installing an air lift system in the city wells have been submitted by F. S. Miller, of the Harris Air Lift Pump Co., of Indianapolis, Ind., to the electric light and water bd.

East Troy, Wis.—The extension of the water mains is contemplated.

South Bend, Ind.—The council com. has reported in favor of an air lift system for the water-works.

Hastings, Ok.—Will vote on the question of issuing bonds for constructing a water-works system.

Pryor Creek, Ok.—The business men are urging the mayor and council to call an election to vote on the issue of bonds for constructing a water-works system.

CONTRACTS TO BE LET.

Portland, Ore.—Bids are asked until Sept. 11 for furnishing this city with 500 fire hydrants.

Harrisonburg, La.—Bids are asked until Oct. 5 for drilling a 4-in. artesian well. H. W. Bethard, secy.

Aberdeen, S. D.—Bids are asked until Sept. 21 for constructing an artesian well. F. W. Raymond, cy. audt.

Warsaw, Ill.—Bids are asked until Sept. 2 for constructing a water works system. A. H. Worthen, cy. clk.

Manchester, Mass.—Bids are asked until Sept. 4 for erecting a steel standpipe. F. J. Merrill, chmn. bd. water comrs.

Evansville, Ind.—Bids are asked until Sept. 24 for constructing a mechanical filtration plant. J. W. Peck, supt.

Mitchell, S. D.—Bids are asked until Sept. 7 for constructing a 4-in. water main in 5th st. L. L. Ness, cy. audt.

Muskegon, Mich.—Bids are asked until Sept. 8 for furnishing a new 6-mil. gallon pump for the local pumping station. B. H. Tellman, cy. recdr.

Vancouver, B. C.—Bids are asked until

Oct. 14 for furnishing c. i. pipes, steel pipes and Ludlow water hydrants. W. McQueen, cy. clk.

Cloquet, Minn.—Bids are asked until Sept. 7 for laying a water main, the city to furnish pipe and hydrants. Jos. Loisel, cy. clk.

Ft. Barrancas, Fla.—Sealed bids are asked until Sept. 2 for laying a 3-in. water main and necessary connections. Capt. D. W. Hand, const. Q. M.

University, Ala.—Bids are asked until Sept. 7 for constructing a complete water works system. Dr. John W. Abercrombie, prest. University of Ala.

Ft. McPherson, Ga.—Bids are asked until Sept. 4 for sinking 1 or 2 8-in. tubular wells at this post. Lieut. W. E. Holliday, constr. Q. M.

Boston, Mass.—Bids are asked until Sept. 2 for laying 12,400 ft. of c. i. water pipe in Boston and Brookline. Henry H. Sprague, chmn. Met. Water B.

Springfield, Mass.—Sealed bids are asked until Sept. 9 for constructing about 12 mis. of 42-in. pipe line. C. H. Bennett, chmn. bd. water comrs.

Platte, S. D.—Sealed bids are asked until Sept. 2 for erecting a steel water tower with steel tank, and 11,424 ft. of 4, 6 and 8-in. water mains. W. F. Van Der Voort, cy. audt.

Winnetka, Ill.—Bids are asked until 8 p. m. Sept. 1 for constructing a mechanical water filtration plant for purifying the village water supply. Wm. B. McIlvaine, prest. vil. bd.

Philadelphia, Pa.—Bids are asked until Sept. 3 for apparatus for cleaning slow sand filters at the Upper and Lower Roxborough and Torresdale filters. Geo. W. Stearns, dir. pub. wks.

Morenci, Ariz.—Sealed bids are asked until Sept. 16 for grading and laying about 25,000 ft. of 10-in. wrought steel pipe over rough country. C. P. Chester, supt. Morenci Water Co.

Salt Lake City, Utah.—Sealed bids are asked until Sept. 8 for furnishing a large quantity of wooden, steel pipe, valves, etc. Wm. J. Lynch, prest. State Land Bd. Reservoir and Irrigation Comrs.

CONTRACTS AWARDED.

Grove City, Minn.—The contract for constructing a steel water tower was awarded to Fairbanks, Morse & Co., of St. Paul, for $2,500.

Seattle, Wash.—The contract for constructing water mains in 7th ave. was awarded to the Coast Concrete Co., Pacific Blk., for $9,925.

Yonkers, N. Y.—The contract for furnishing c. i. pipe was awarded, Aug. 17, to the Camden Iron Works, of Philadelphia, for $21.80 a ton, or $7,117.

Boston, Mass.—The contract for repairing engines Nos. 3 and 4 at the pumping station, Calf Pasture, was awarded to the Lockwood Mfg. Co., for $23,500.

DeFuniak Springs, Fla.—The contract for constructing a water works system was awarded, Aug. 15, to J. B. McCrary & Co., of Atlanta, Ga., for $17,821.65.

Annapolis, Md.—The contract for the extension of the water system at the U. S. Naval Academy here was awarded to the McCay Engineering Co., 9 E. Lexington st., Baltimore.

New York City.—The contract for constructing 6½ mis. of the Catskill aqueduct between Rondout creek and the Ashokan dam, has been awarded to the Stewart-Kerbaugh-Shanley Co., for $2,368,920.

Centralia, Ill.—The contract for installing a new triple expansion pump at the water works station was awarded to the F. H. Prescott Mfg. Co., of Milwaukee, for $7,640.

Ames, Ia.—The contract for the extension of the distributing system of the water works plant was awarded to the Des Moines Bridge and Iron Co., of Des Moines, for $14,990.

Springfield, Ill.—The contract for constructing a concrete dam across Sangamon river, near the water works pumping station, was awarded to L. R. Riddle, of Chicago, for $11,550.

Eveleth, Minn.—Bids for constructing 1,250 ft. of water mains in Grand ave. were submitted, Aug. 8, as follows: A. M. Peterson, $4,569; P. E. Dowling, $4,351; Pastoret & Lunz, Two Harbors, $3,900.

Meriden, Conn.—The contract for furnishing 190 tons of 12-in. pipe and fittings to extend the water mains to South Meriden was awarded to the Warren Foundry Co., of New York City, at $23.40 a ton for pipe and $47.50 a ton for fittings.

Los Angeles, Cal.—The bids received July 27 for constructing the Jawbone division of the Los Angeles aqueduct were rejected and the work will be done under the supervision of the advisory committee and the aqueduct engineers by force account.

Columbus, O.—The state board of public works awarded contracts, Aug. 16, as follows: Constructing Loramie water weir, Kinnear Bros., of Columbus, $11,000; constructing bulkhead at Loramie reservoir and the feeder waste gate at the same place, Myers & Clark, of Dayton, $1,654 and $1,818, respectively; constructing waste weir at Buckeye Lake, Kinnear Bros., $4,999.87. The contract for furnishing 6,000 bbls. of cement was awarded to the Superior Portland Cement Co., of Charleston, W. Va., for $9,121.35.

Trenton, N. J.—Bids were submitted Aug. 12 for constructing and installing a pumping engine, with crank and flywheel, at the pump house on Calhoun st., as follows: Camden Iron Wks., of Philadelphia, Pa., $84,500; the Hooven-Owens-Rentschler Co., of Hamilton, O., $87,300; Holly Mfg. Co., of Buffalo, N. Y., $91,769; Allis-Chalmers Co., of Milwaukee, Wis., $92,900; Wisconsin Engine Co., of Corliss, Wis., $95,410. Southwark Machine Co., of Philadelphia, Pa., $91,500; Bethlehem Steel Co., of South Bethlehem, Pa., $98,525; Platt Iron Wks., of Dayton, O., $107,500. Chas. A. Hague, Consulting Engr., 52 Broadway, New York, N. Y.

Philadelphia, Pa.—Bids were submitted Aug. 18 for a coal and ash handling plant at Lardner's Point pumping station. The bids were received under three items, as follows: Item 1, for wharf dredging, tracks, scales, grading, walls, with all appurtenances; item 2, for elevator tower, ash tunnel, oil vault, bridges, coal bins, with all appurtenances; item 3, for all coal and ash-handling machinery, with supports and electric equipment, with all appurtenances. The bidders for the entire works were as follows: Millard Construction Co., 1st item, $29,500; 2nd item, $79,000; 3rd item, $24,900; time of completion, 150 days. Lindsay & Co., 1st item, $29,940; 2nd item, $79,800; 3rd item, $27,400; 150 days. The other bids submitted were: Filbert Paving and Construction Co., 1st item, $31,911; 3rd item, $27,241; time of completion, 150 days. Edwin Fay & Sons, 1st, $31,941; 3rd, $64,990; 150 days. Bennis Construction Co., 1st, $31,300; 150 days. Rigg & Co., 1st, $32,585; 125 days. Exeter Machine Wks., 3rd, $27,600. Link Belt Engineering Wks., 3rd, $28,595.

BRIDGES.

Ashland, O.—Sealed bids are asked until Sept. 10 for constructing certain bridges. E. B. Westover, co. audt.

Rensselaer, Ind.—Bids are asked until Sept. 8 for constructing a steel bridge across Kankakee river. Co. comrs.

Lancaster, O.—Sealed bids are asked until Sept. 12 for constructing several bridges. H. C. Belt, clk. co. comrs.

Defiance, O.—City Engr. Toberan has prepared preliminary plans and estimates for a new bridge over the canal at 5th st.

Moscow, Idaho.—Sealed bids are asked until Sept. 14 for constructing 2 bridges. Alex. P. Ramstedt, clk. co. comrs.

Paoli, Ind.—Sealed bids are asked until Sept. 8 for constructing bridges. Geo. R. Cadle, chmn. co. comrs.

Chambersburg, Pa.—Bids are asked until Sept. 5 for constructing 2 reinforced concrete bridges. J. E. Royer, chmn. co. comrs.

Independence, Kas.—Sealed bids are asked until Sept. 14 for erecting 1 concrete bridge and 16 steel bridges. E. H. Stewart, co. clk.

Speedwell, Va.—Bids are asked until Sept. 7 for constructing an iron bridge and abutments. Address A. L. Porter, Rural Retreat, Va.

Cleveland, O.—Sealed bids are asked until Sept. 5 for constructing a concrete bridge in Middleburg twp. Wm. F. Black, clk. co. comrs.

Pottstown, Pa.—Sealed bids are asked until Sept. 9 for constructing a bridge over the Manatawny creek. Benj. F. Penrose, chmn. co. comrs.

Scranton, Pa.—Mayor Tripp has signed an ordinance directing the city engineer to furnish an estimate of the cost of a viaduct over Tripp's crossing.

Benton Harbor, Mich.—Sealed bids are asked until Sept. 7 for constructing a timber bridge over Ox creek, on the Lake Shore drive. A. J. Burger, cy. clk.

Harrisburg, Pa.—Mayor Meals has approved the resolution requiring cy. engr. Cowden to make estimates for constructing a bridge across the grade crossing at Derry and 18th sts.

Ocala, Fla.—Bids are asked until Sept. 9 for constructing steel bridges across the Ocklawaha river, at Sharp's Ferry, and at Moss Bluff Ferry. S. T. Sistrunk, clk. bd. co. comrs.

Chicago, Ill.—Sealed bids are asked until Sept. 2 for the equipment of the eight-track bridge at Campbell ave. Robert R. McCormick, prest. bd. trustees, Sanitary Dist. of Chicago.

Atlantic City, N. J.—Sealed bids are asked until 11:30 a. m., Sept. 2, for constructing a bridge over Inside Thoroughfare, at Dorset Place, in Ventnor City. E. D. Rightmire, co. engr.

Great Falls, Mont.—Special.—The county commissioners will ask for bids for constructing a new steel bridge across Hound creek, above Truly, to replace the one destroyed by high water last spring.

Chillicothe, O.—Bids are asked until Sept. 7 for constructing the superstructures of certain bridges and for 2 concrete abutments on pile foundation for each of the bridges. Chas. H. Pinto, co. audt.

Post Falls, Idaho.—The county commissioners have decided to abandon the old county bridges spanning the three channels of the Spokane river here, and erect a bridge at the foot of Spokane st.

York, Pa.—Sealed bids are asked until 1 p. m. Sept. 2 for erecting a sub and superstructure of a county bridge over the west branch of Codorus creek, near Porter's Siding. C. B. King, clk. co. comrs.

Ithaca, N. Y.—Bids, designs and plans are asked until Sept. 9 for furnishing and erecting 3 steel highway bridges over the Cayuga Inlet, at State, Seneca and Buffalo sts. F. C. Stevens, supt. pub. wks.

Crown Point, Ind.—Bids are asked until Sept. 8 for constructing a concrete arch in Cedar Creek twp., and for raising the Forsyth ave. bridge across Calumet river, at East Chicago. Chas. A. Johnson, co. audt.

Salinas City, Cal.—Bids are asked until Sept. 8 for the extension and repairs to the Hilltown bridge jetties on the Salinas river, and for the construction of a concrete bridge across Toro creek. Lou G. Hare, co. supvr.

Morenci, Ariz.—Bids are asked until Sept. 16 for erecting 1 light steel truss bridge, 1 steel frame corrugated iron power house building, 1 steel oil tank, auxiliary water tank and miscellaneous steel work. C. P. Chester, supt. Morenci Water Co.

STREET LIGHTING.

Colorado Springs, Col.—A municipal electric light plant is contemplated.

Cumberland, Wis.—Plans for a municipal electric light plant are being prepared.

Price, Utah.—Estimates are being prepared for a municipal electric light plant.

Pasco, Wash.—The Pasco Light and Water Co. contemplates the immediate construction of a plant.

Placerville, Cal.—The question of constructing an electric light plant is under consideration.

Macon, Ga.—The installation of an electric light and water plant is contemplated. J. W. Wilcox, mayor.

Waterloo, Ill.—The city council has purchased a site and will construct an electric light and power plant.

Sparta, Mich.—Voted to issue $20,000 bonds for constructing an electric light plant. E. G. Anderson, vil. clk.

Hartford, Conn.—Bids are asked until Sept. 14 for lighting the streets with electricity for 1 and 5 yrs. Cy. clk.

Basic City, Va.—The city council contemplates the installation of an electric light and power plant. W. H. Page, mayor.

Ponce, P. R.—Bids are asked until Oct. 15 for the construction of an electric light plant. Blas C. Silva, cy. engr.

Kenosha, Wis.—Bids are asked until Sept. 8 for electric street lighting for 5 and 10 yrs. Geo. W. Harrington, cy. clk.

Gadsden, Ala.—Plans for the proposed water power plant of the Coosa River Electric Power Co. are being prepared. Roswell H. Cobb, prest.

St. Cloud, Minn.—The Union Power Co., recently organized, contemplates the construction of an electric light and power plant in this city.

Winnipeg, Man.—Bids are asked until Sept. 15 for constructing an electric light plant and for carbons. F. A. Cambridge, cy. electrician.

Green Bay, Wis.—Bids are asked until Sept. 23 for gas and electric fixtures, etc., for the county court house. Elmer S. Hall, co. clk.

Tacoma, Wash.—Bids are asked until Sept. 19 for constructing a water power, electric light and power plant. H. J. McGregor, comr. pub. wks.

Chicago, Ill.—Bids are asked until Sept. 2 for 6,000 10-c.p. carbon filament 109 to 115-volt lamps. South Park comrs., 57th and Cottage Grove ave.

Richlands, Va.—Plans are being considered for the construction of an electric light plant and water works and sewerage systems. C. B. Noel, chmn. com.

Humboldt, Tenn.—Contracts for the equipment for the municipal electric light plant have been awarded to the Chase Engine and Mfg. Co., of Mattoon, Ill.

Lebanon, Ore.—The Lebanon Electric Light and Water Co. has been incorporated by S. P. Bach, Samuel M. Garland, J. C. Mayer, P. M. Scroggins and S. I. Stewart.

Russellville, Ala.—Contracts will be let about Sept. 1 for constructing municipal electric light and water plants. Edgar B. Kay, engr.-in-charge, Tuscaloosa, Ala.

Galesburg, Ill.—Bids are asked until Sept. 1 for wiring the county almshouse and outbuildings and piping for lighting them with gas. Frank L. Adams, co. clk.

Ashland, Me.—A change from steam to water power and the construction of seven transmission lines is contemplated by C. A. Flint, owner of the electric light plant here.

Pikeville, Ky.—The Pike Light and Power Co. is planning to install a boiler, generator and engine, and to establish a day circuit with about 70 fans connected. L. L. Stone, owner.

Rangeley, Me.—The Rangeley Light and Power Co. has under consideration the question of doubling its output during 1909, at a cost of about $50,000. D. D. Elliott, prest. and mgr.

Pulaski, Va.—Plans are being prepared for the development of water power 15 mls. from here, for lighting this city. Bids will probably be received about Sept. 1. John T. Loving, mayor.

Mayfield, Ky.—The Mayfield Water and Light Co. will erect a power plant. The contract for the concrete work and house has been awarded to the Weidenfeller Construction Co., of Chicago.

White Plains, N. Y.—Bids are asked until Sept. 10 for electrical equipment, engine and dynamos, to be used in the supreme court building and Hall of Records. Chauncey T. Secor, chmn. New Court House com.

Seguin, Tex.—The Seguin Electric Light and Power Co. is preparing plans for rebuilding its water power plant, and contemplates reconstructing its transmission lines within the next six months. L. A. Voigt, mgr.

Lewiston, Idaho.—Preliminary plans are being prepared by the Umatilla Mining Co. for the construction of a power plant at the confluence of the Clearwater river and Ten Mile creek. Jacob Schlooser, prest., Chicago.

Portsmouth, O.—Sealed bids are asked until Sept. 24 for lighting the streets, alleys and public places with electricity, gas, gasoline, alcohol or other illuminating medium for 3, 6 or 10 yrs. Martin W. McMahon, clk. B. P. W.

Chicago, Ill.—Bids are asked until Sept. 24 for furnishing and installing a generator, turbine water wheel unit, switchboards, transformers and wiring electrical apparatus. I. J. Bryan, clk. bd. trustees, Sanitary Dist. of Chicago.

Cuyahoga Falls, O.—Contracts for rebuilding the municipal electric light plant have been awarded as follows: generator, exciter and switchboard, Crocker-Wheeler Co., Ampere, N. J.; engine, Shepard Engine Co., of Williamsport, Pa.

Goshen, Ind.—The water-works and light com. has been instructed to prepare plans for a new arc light system. The new equipment will include a 60-HP. engine, a generator, 3 transformers, a switchboard and 150 arc lights of inclosed pattern.

Mackay, Idaho.—The erection of a hydro-electric plant on Cedar Creek, near here, is contemplated by the Lost River Light & Power Co., to furnish electricity for lamps and motors in Mackay and the copper mines in this vicinity. W. J. McConnell, prest., Boise, Idaho.

Indianapolis, Ind.—The Indiana Lighting Co. has been organized to furnish light, heat and power to Ft. Wayne, Bluffton, Montpelier, Anderson, Lafayette, West Lafayette, Logansport, Peru, Wabash, Decatur, Geneva, Crawfordsville, Lebanon, Thorntown and Frankfort in Indiana, and Lima, Wapakoneta, Celina, St. Mary's, Greenville, Fort Recovery, North Mercer, and Coldwater in Ohio.

PARKS.

New Haven, Conn.—This city has purchased a 16-acre tract as an addition to East Rock Park.

Deadwood, S. D.—This city voted to issue $25,000 for a public park and has several sites under consideration.

Los Angeles, Cal.—Park Superintendent Morley estimates that $500,000 will be required for the parks of this city next year.

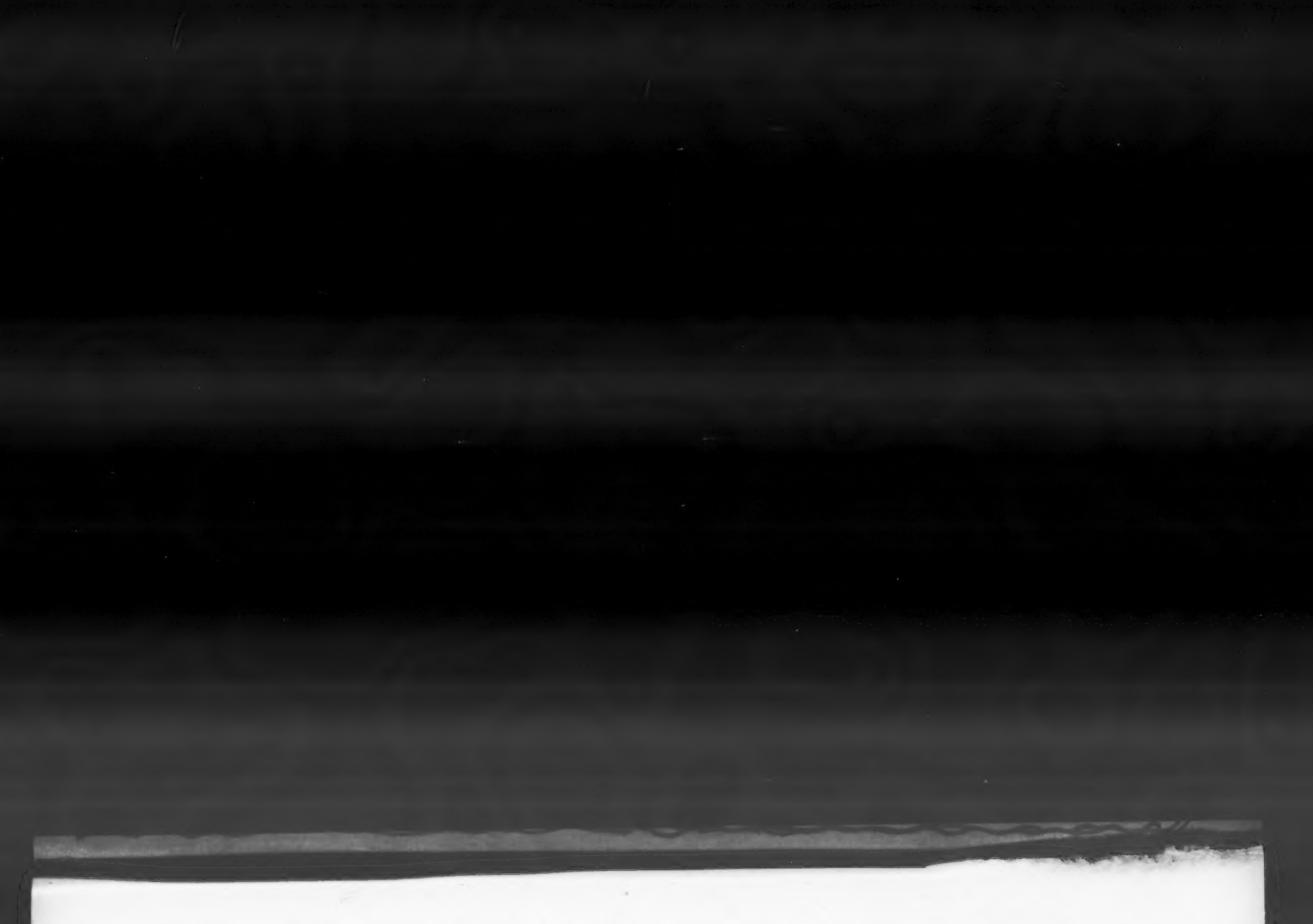
Danville, Ind.—A stock company has been formed here to purchase the old fair grounds and race track and convert it into a public park.

Dubuque, Ia.—A voluntary park association has raised $20,000 for the purchase of a tract of land, known as Eagle Point, for a public park.

Holyoke, Mass.—A report on park improvements for this city has been prepared by Olmsted Bros., of Brookline, which involves extensive plans for beautifying Connecticut river.

Tulsa, Okla.—Plans have been prepared by city engineer Hughes for the development of a system of parks, to include two tracts of 53 and 193 acres, respectively, and a river drive connecting them.

Pana, Ill.—A 40-acre tract of land has been presented to this city by Hon. J. W. Kitchell, and will be improved as a park. According to press reports, Mayor H. N. Schuyler desires to secure the services of a landscape architect to plan and improve it.

FIRE APPARATUS.

Portland, Ore.—Bids are asked until Sept. 11 for furnishing 500 fire hydrants.